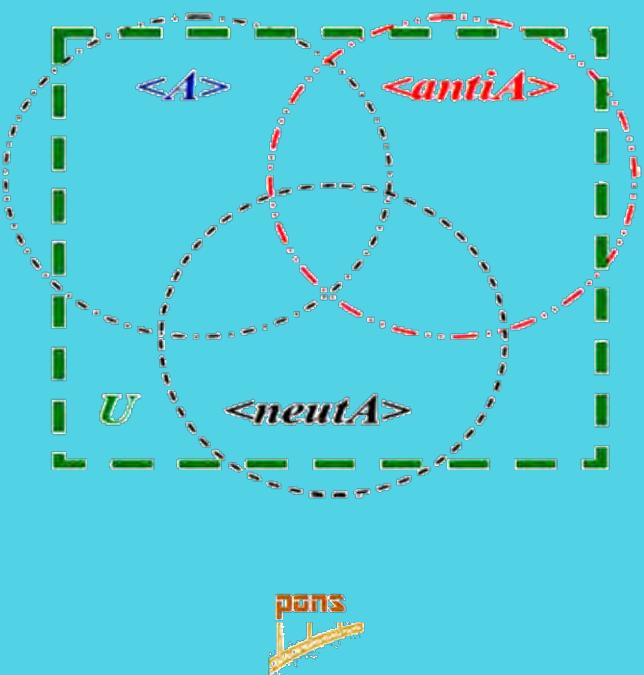


FLORENTIN SMARANDACHE

***Unmatter Plasma,  
Relativistic Oblique-Length  
Contraction Factor,  
Neutrosophic Diagram  
and Neutrosophic Degree  
of Paradoxicity***

*Articles and Notes*



**Florentin Smarandache**

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Contraction Factor, Neutrosophic Diagram and  
Neutrosophic Degree of Paradoxicity.**

**Articles and Notes**

ISBN 978-1-59973-346-3

E-publishing:  
Georgiana Antonescu  
Pons asbl  
Bruxelles, Quai du Batelage, 5, Belgium

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*Pons Publishing*  
Brussels, 2015

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On the cover: *Example of a particular neutrosophic diagram.*

## Foreword

This book has four parts. In the first part, we collected five recent papers, published before in *Progress in Physics*, but reviewed.

In the first paper, we approach a novel form of plasma, Unmatter Plasma. The electron-positron beam plasma was generated in the laboratory in the beginning of 2015. This experimental fact shows that unmatter, a new form of matter that is formed by matter and antimatter bind together (mathematically predicted a decade ago) really exists. That is the electron-positron plasma experiment of 2015 is the experimentum crucis verifying the mathematically predicted unmatter.

In the second paper, we generalize the Lorentz Contraction Factor for the case when the lengths are moving at an oblique angle with respect to the motion direction, and show that the angles of the moving relativistic objects are distorted.

In the third paper, using the Oblique-Length Contraction Factor, which is a generalization of Lorentz Contraction Factor, we show several trigonometric relations between distorted and original angles of moving object lengths in the Special Theory of Relativity.

In the fourth paper, after a short history of logics: from particular cases of 2-symbol or numerical valued logic to the general case of n-symbol or numerical valued logic, we show generalizations of 2-valued Boolean logic to fuzzy

logic, also from the Kleene's and Lukasiewicz' 3-symbol valued logics or Belnap's 4-symbol valued logic to the most general numerical valued refined neutrosophic logic. Two classes of neutrosophic norm (n-norm) and neutrosophic conorm (n-conorm) are defined. Examples of applications of neutrosophic logic to physics are listed.

Finally, in the last paper, we discuss some paradoxes which we call "neutrosophic" since they are based on indeterminacy (or neutrality, i.e. neither true nor false), which is the third component in neutrosophic logic. We generalize the Venn diagram to a Neutrosophic Diagram, which deals with vague, inexact, ambiguous, ill-defined ideas, statements, notions, entities with unclear borders. We define the neutrosophic truth table, then we introduce two neutrosophic operators (neuterization and antonymization operators), and give many classes of neutrosophic paradoxes.

In the second and third parts of this book, we collected notes, abstracts, reviews, blogs and comments on different topics related to physics, e.g. neutrosophic physics as a new field of research, neutrosophic numbers in physics, neutrosophic degree of paradoxicity, unparticle and unmatter, multispace and multistructure, nucleon clusters, and others.

In the fourth part of the book, we listed our contributions to American Physical Society, as also reflected by the Bulletin of American Physical Society at <http://www.aps.org>.

*The Author*

# ARTICLES

## 1. Unmatter Plasma discovered

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Unmatter Plasma is a novel form of plasma, exclusively made of matter and its antimatter counterpart. It was first generated in the 2015 experiment [1, 2] based on the 2004 considerations [3]. Unmatter is formed by combinations of matter and antimatter that bound together, or by long-range mixture of matter and antimatter forming a weakly-coupled phase.

The electron-positron beam plasma was generated in the laboratory in the beginning of 2015. This experimental fact shows that unmatter, a new form of matter that is formed by matter and antimatter bind together (mathematically predicted a decade ago) really exists. That is the electron-positron plasma experiment of 2015 is the experimentum crucis verifying the mathematically predicted unmatter.

---

### 1.1. Introduction

There are four fundamental states of matter: solid, liquid, gas, and plasma.

Plasma consists of positive ions and free electrons (negative particles), typically at low pressures, and it is

overall almost neutral. Plasma is an ionized gas (as in fluorescent neon, in lightning, in stars, in nuclear reactors).

An ion is a positive or negative charged particle. A positive ion is called cation, while a negative ion is called anion. If the ion is an atom, then it may contain less electrons than needed for being neutrally charged (hence one has a cation), or more electrons than needed for being neutrally charged (hence one has an anion). Similarly, if the ion is a molecule or a group (of atoms or molecules).

The process of forming ions is called ionization. The degree of ionization depends on the proportion of atoms that have lost or gained electrons. By applying a strong electromagnetic field to a gas, or by heating a gas, one obtains plasma.

## 1.2. Definition of Unmatter

Unmatter [4-6] is formed by combinations of matter and antimatter that bind together, or by long-range mixture of matter and antimatter forming a weakly-coupled phase.

Binding and bound state means that the interaction is sufficiently strong to tie together the particles of a system, therefore hindering them from becoming free. For example, a usual liquid is a bound state of molecules, while a gas is an un-bounded where the molecules can move freely in successive collisions.

Weakly-coupled means that the interaction is too week to form a bound state, but it is not that week to let the particles be free. For example, the liquid molecules

closer to the surface are weakly coupled and they can evaporate.

Long-range means that the interaction (either weak or strong) between particles extends in space on long lengths. For example, the superconductive state in metals is based on pairs of electrons whose interactions are long-range, i.e. it is not confined into a limited spatial region.

Mixture means a collective state of particles: a combination of non-miscible particles for example.

Phase corresponds to the notion of phase of the matter.

For example, the electron-positron pair is a type of unmatter. We coined the word “unmatter” that means neither matter nor antimatter, but something in between.

Besides matter and antimatter there may exist unmatter (as a new form of matter) in accordance with the neutrosophy theory that between an entity and its opposite there exist intermediate entities.

### 1.3. Definition of Unmatter Plasma

Unmatter Plasma is a novel form of plasma, exclusively made of matter and its antimatter counterpart.

The 2015 experiment [1, 2] on matter-antimatter plasma (or unmatter plasma, in terms of the neutrosophic logic and statistics) was recently successful at the Astra Gemini laser facility at the Rutherford Appleton Laboratory, Oxford, United Kingdom.

The 2015 experiment has produced electron-positron plasma. The positron is the antimatter of the electron,

having an opposite charge of the electron, but the other properties are the same.

## 1.4. The Neutrosophic Triplets

The neutrosophic triplets also reflect the matter, unmatter, and antimatter. They are defined as follows [7]:

Let  $N$  be a set together with a binary operation  $*$ . Then  $N$  is called a neutrosophic triplet set if for any  $a \in N$ , there exist a neutral of " $a$ " called  $neut(a)$ , different from the classical algebraic unitary element, and an opposite of " $a$ " called  $anti(a)$ , with  $neut(a)$  and  $anti(a)$  belonging to  $N$ , such that:

$$a * neut(a) = neut(a) * a = a,$$

and

$$a * anti(a) = anti(a) * a = neut(a).$$

The elements  $a$ ,  $neut(a)$  and  $anti(a)$  are collectively called as neutrosophic triplet and we denote it by  $(a, neut(a), anti(a))$ . By  $neut(a)$ , we means *neutral* of  $a$  and apparently,  $a$  is just the first coordinate of a neutrosophic triplet and not a neutrosophic triplet.

For the same element " $a$ " in  $N$ , there may be more neutrals to it  $neut(a)$  and more opposites of it  $anti(a)$ .

## 1.5. Verifications of Unmatter

"The meson is a clear example of "Unmatter" whose configuration includes a pair quark-antiquark. "Unmatter" is mostly expected to emerge in exotic states outside the boundaries of the Standard Model for particle physics (for

example in the Dark Matter sector) and in the regime of high-energy astrophysical objects" [8].

## 1.6. Verification of Unmatter Plasma

"It is definitely a jet of unmatter, because a plasma consisting of the electrons and the positrons is neither matter nor antimatter in the same time. This experiment is the truly verification of unmatter as the theoretical achievements of fuzzy logics and statistics. This experiment is a milestone of both experimental physics and pure mathematics" [9].

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Originally published in PROGRESS IN PHYSICS. (Letters to The Editor), Volume 11 (2015), Issue 3 (July), p. 246.  
Reviewed.

## 2. Oblique-Length Contraction Factor in the Special Theory of Relativity

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In this paper one generalizes the Lorentz Contraction Factor for the case when the lengths are moving at an oblique angle with respect to the motion direction. One shows that the angles of the moving relativistic objects are distorted.

---

### 2.1. Introduction

According to the Special Theory of Relativity, the Lorentz Contraction Factor is referred to the lengths moving along the motion direction. The lengths which are perpendicular on the direction motion do not contract at all [1]. In this paper one investigates the lengths that are oblique to the motion direction and one finds their *Oblique-Length Contraction Factor* [3], which is a generalization of the Lorentz Contraction Factor (for  $\theta = 0$ ) and of the perpendicular lengths (for  $\theta = \pi/2$ ). We also calculate the distorted angles of lengths of the moving object.

### 2.2. Length-Contraction Factor

**Length-Contraction Factor**  $C(v)$  is just Lorentz Factor:

$$C(v) = \sqrt{1 - \frac{v^2}{c^2}} \in [0,1] \text{ for } v \in [0, c]. \quad (2.1)$$

$$L = L' \cdot C(v), \quad (2.2)$$

where  $L$  = non-proper length (length contracted),  
 $L'$  = proper length.

$C(o) = 1$ , meaning no space contraction {as in Absolute Theory of Relativity (ATR)}.

$C(c) = o$ , which means according to the Special Theory of Relativity (STR) that if the rocket moves at speed “ $c$ ” then the rocket length and laying down astronaut shrink to zero!

This is unrealistic.

### 2.3. Time-Contraction Factor

**Time-Dilation Factor**  $D(v)$  is the inverse of Lorentz Factor:

$$D(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \in [1, +\infty] \text{ for } v \in [0, c] \quad (2.3)$$

$$\Delta t = \Delta t' \cdot D(v) \quad (2.4)$$

where  $\Delta t$  = non-proper time and

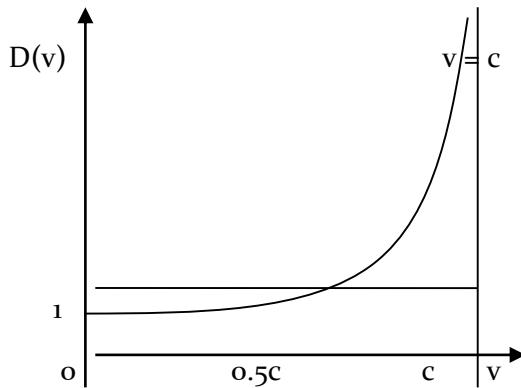
$\Delta t'$  = proper time.

$D(0) = 1$ , meaning no time dilation {as in the Absolute Theory of Relativity (ATR)};

$$D(c) = \lim_{v \rightarrow c} D(v) = +\infty,$$

which means, according to the Special Theory of Relativity (STR), that if the rocket moves at speed “ $c$ ”, then the observer on earth measures the elapsed non-proper time as infinite, which is unrealistic.

$v = c$  is the equation of the vertical asymptote to the curve of  $D(v)$ .



*Fig. 2.1. The graph of the Time-Dilation Factor*

## 2.4. Oblique-Length Contraction Factor

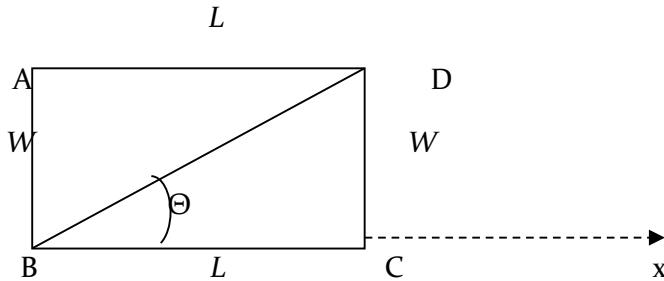
The Special Theory of Relativity asserts that all lengths in the direction of motion are contracted, while the lengths at right angles to the motion are unaffected. But it didn't say anything about lengths at oblique angle to the motion (i.e. neither perpendicular to, nor along the motion direction), how would they behave?

This is a generalization of Galilean Relativity, i.e. we consider the oblique lengths.

The length contraction factor in the motion direction is:

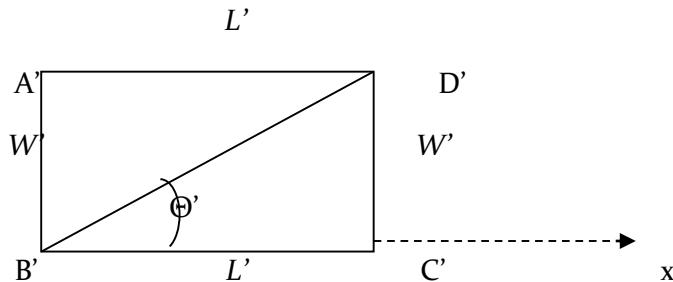
$$C(v) = \sqrt{1 - \frac{v^2}{c^2}}. \quad (2.5)$$

Suppose we have a rectangular object with width  $W$  and length  $L$  that travels at a constant speed  $v$  with respect to an observer on Earth.



*Fig. 2.2. A rectangular object moving along the x-axis*

Then its lengths contract and its new dimensions will be  $L'$  and  $W'$ :



*Fig. 2.3. Contracted lengths of the rectangular object moving along the x-axis*

where  $L' = L \cdot C(v)$  and  $W' = W$ .

The initial diagonal of the rectangle ABCD is:

$$\begin{aligned}\delta &= |AC| = |BD| = \sqrt{L^2 + W^2} = \sqrt{L^2 + L^2 \tan^2 \theta} \\ &= L \sqrt{1 + \tan^2 \theta}\end{aligned}\tag{2.6}$$

while the contracted diagonal of the rectangle A'B'C'D' is:

$$\begin{aligned}\delta' &= |A'C'| = |B'D'| = \sqrt{(L')^2 + (W')^2} = \\ &\sqrt{L^2 \cdot C(v)^2 + W^2} = \sqrt{L^2 C(v)^2 + L^2 \tan^2 \theta} = \\ &L \sqrt{C(v)^2 + \tan^2 \theta}\end{aligned}\quad (2.7)$$

Therefore, the lengths at oblique angle to the motion are contracted with the oblique factor

$$\begin{aligned}OC(v, \theta) &= \frac{\delta'}{\delta} = \frac{L \sqrt{C(v)^2 + \tan^2 \theta}}{L \sqrt{1 + \tan^2 \theta}} = \sqrt{\frac{C(v)^2 + \tan^2 \theta}{1 + \tan^2 \theta}} \\ &= \sqrt{C(v)^2 \cos^2 \theta + \sin^2 \theta},\end{aligned}\quad (2.8)$$

which is different from  $C(v)$ .

$$\delta' = \delta \cdot OC(v, \theta), \text{ where } 0 \leq OC(v, \theta) \leq 1. \quad (2.9)$$

For unchanged constant speed  $v$ , the greater is  $\theta$  in  $(0, \frac{\pi}{2})$  the larger gets the oblique-length contradiction factor, and reciprocally.

By oblique length contraction, the angle

$$\theta \in (0, \frac{\pi}{2}) \cup (\frac{\pi}{2}, \pi) \quad (2.10)$$

is not conserved.

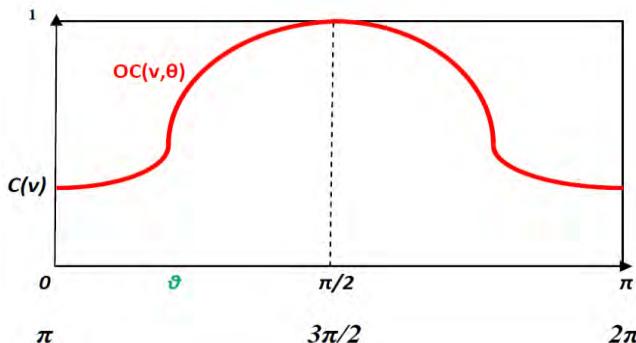


Fig. 2.4. Graph of the Oblique-Length Contraction Factor  $OC(v, \theta)$

In Fig. 4 the horizontal axis represents the angle  $\theta$ , while the vertical axis represents the values of the Oblique-Length Contraction Factor  $OC(v, \theta)$  for a fixed speed  $v$ . Hence  $C(v)$  is thus a constant in this graph.

The graph, for  $v$  fixed, is periodic of period  $\pi$ , since:

$$\begin{aligned} OC(v, \pi + \theta) &= \sqrt{C(v)^2 \cos^2(\pi + \theta) + \sin^2(\pi + \theta)} \\ &= \sqrt{C(v)^2 [-\cos(\theta)]^2 + [-\sin \theta]^2} \\ &= \sqrt{C(v)^2 \cos^2 \theta + \sin^2 \theta} = OC(v, \theta). \end{aligned} \quad (2.11)$$

More exactly about the  $OC(v, \theta)$  range:

$$OC(v, \theta) \in [C(v), 1], \quad (2.12)$$

but since  $C(v) \in [0, 1]$ , one has:

$$OC(v, \theta) \in [0, 1]. \quad (2.13)$$

The Oblique-Length Contractor

$$OC(v, \theta) = \sqrt{C(v)^2 \cos^2 \theta + \sin^2 \theta} \quad (2.14)$$

is a generalization of Lorentz Contractor  $C(v)$ , because: when  $\theta = 0$ , or the length is moving along the motion direction, then  $OC(v, 0) = C(v)$ . Similarly

$$OC(v, \pi) = OC(v, 2\pi) = C(v). \quad (2.15)$$

Also, if  $\theta = \pi/2$ , or the length is perpendicular on the motion direction, then  $OC(v, \pi/2) = 1$ , i.e. no contraction occurs. Similarly  $OC(v, \frac{3\pi}{2}) = 1$ .

## 2.5. Angle Distortion

Except for the right angles ( $\pi/2, 3\pi/2$ ) and for the  $0, \pi$ , and  $2\pi$ , all other angles are distorted by the Lorentz transform.

Let's consider an object of triangular form moving in the direction of its bottom base (on the  $x$ -axis), with speed  $v$ , as below:

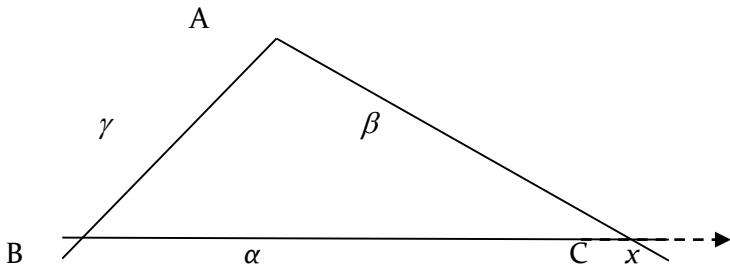


Fig. 2.5

The side  $|BC| = \alpha$  is contracted with the contraction factor  $C(v)$  since  $BC$  is moving along the motion direction, therefore  $|B'C'| = \alpha \cdot C(v)$ .

But the oblique sides  $AB$  and  $CA$  are contracted respectively with the oblique-contraction factors  $OC(v, \angle B)$  and  $OC(v, \angle \pi - C)$ , where  $\angle B$  means angle  $B$ :

$$|A'B'| = \gamma \cdot OC(v, \angle B) \quad (2.16)$$

$$\text{and } |C'A'| = \beta \cdot OC(v, \angle \pi - C) = \beta \cdot OC(v, \angle A + B), \quad (2.17)$$

$$\text{since } \angle A + \angle B + \angle C = \pi. \quad (2.18)$$

Triangle  $ABC$  is shrunk, distorted to  $A'B'C'$  as below:

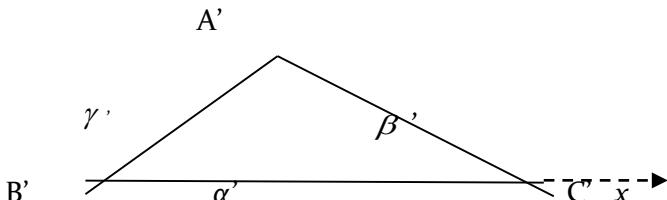


Fig. 2.6

Hence one gets:

$$\alpha' = \alpha \cdot C(v)$$

$$\beta' = \beta \cdot OC(v, \angle A+B) \quad (2.19)$$

$$\gamma' = \gamma \cdot OC(v, \angle B)$$

In the resulting triangle  $A'B'C'$ , since one knows all its side lengths, one applies the Law of Cosine in order to find each angle  $\angle A'$ ,  $\angle B'$ , and  $\angle C'$ .

Therefore:

$$\angle A' = \arccos \frac{-\alpha^2 \cdot C(v)^2 + \beta^2 \cdot OC(v, \angle A+B)^2 + \gamma^2 \cdot OC(v, \angle B)^2}{2\beta \cdot \gamma \cdot OC(v, \angle B) \cdot OC(v, \angle A+B)}$$

$$\angle B' = \arccos \frac{\alpha^2 \cdot C(v)^2 - \beta^2 \cdot OC(v, \angle A+B)^2 + \gamma^2 \cdot OC(v, \angle B)^2}{2\alpha \cdot \gamma \cdot C(v) \cdot OC(v, \angle B)}$$

$$\angle C' = \arccos \frac{\alpha^2 \cdot C(v)^2 + \beta^2 \cdot OC(v, \angle A+B)^2 - \gamma^2 \cdot OC(v, \angle B)^2}{2\alpha \cdot \beta \cdot C(v) \cdot OC(v, \angle A+B)}$$

(2.20)

As we can see, the angles  $\angle A'$ ,  $\angle B'$ , and  $\angle C'$  are, in general, different from the original angles  $\angle A$ ,  $\angle B$ , and  $\angle C$  respectively.

The distortion of an angle is, in general, different from the distortion of another angle.

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Originally published in PROGRESS IN PHYSICS,  
Volume 1 (2013), Issue 1 (January), p. 60-62. Reviewed.

### 3. Relations between Distorted and Original Angles in STR

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**Using the Oblique-Length Contraction Factor, which is a generalization of Lorentz Contraction Factor, one shows several trigonometric relations between distorted and original angles of moving object lengths in the Special Theory of Relativity.**

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#### 3.1. Introduction

The lengths at oblique angle to the motion are contracted with the *Oblique-Length Contraction Factor*  $OC(v, \theta)$ , defined as [3-4]:

$$OC(v, \theta) = \sqrt{C(v)^2 \cos^2 \theta + \sin^2 \theta} \quad (3.1)$$

where  $C(v)$  is just *Lorentz Factor*:

$$(v) = \sqrt{1 - \frac{v^2}{c^2}} \in [0, 1] \text{ for } v \in [0, c]. \quad (3.2)$$

Of course,

$$0 \leq OC(v, \theta) \leq 1. \quad (3.3)$$

The Oblique-Length Contraction Factor is a generalization of Lorentz Contractor  $C(v)$ , because: when  $\theta = 0$ , or the length is moving along the motion direction, then  $OC(v, 0) = C(v)$ . Similarly,

$$OC(v, \pi) = OC(v, 2\pi) = C(v). \quad (3.4)$$

Also, if  $\theta = \pi/2$ , or the length is perpendicular on the motion direction, then  $OC(v, \pi/2) = 1$ , i.e. no contraction occurs. Similarly  $OC\left(v, \frac{3\pi}{2}\right) = 1$ .

### 3.2. Tangential Relations between Distorted Acute Angles vs. Original Acute Angles of a Right Triangle

Let's consider a right triangle with one of its legs along the motion direction.

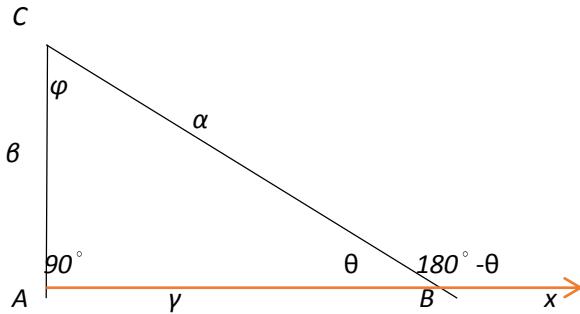


Fig. 3.1

$$\tan \theta = \frac{\beta}{\gamma} \quad (3.5)$$

$$\tan 180^\circ - \theta = -\tan \theta = \frac{\beta}{\gamma}. \quad (3.6)$$

After contraction of the side  $AB$  (and consequently contraction of the oblique side  $BC$ ) one gets:

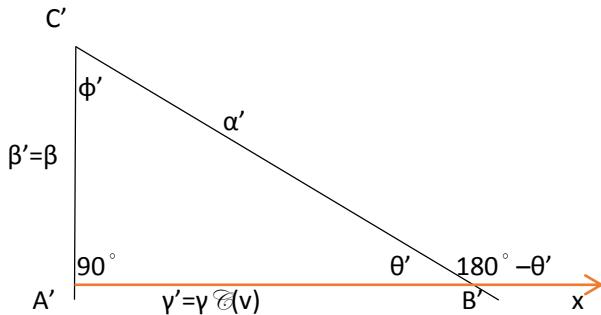


Fig. 3.2

$$\tan 180^\circ - \theta' = -\tan \theta' = -\frac{\beta'}{\gamma'} = -\frac{\beta}{\gamma C(v)} \quad (3.7)$$

Then:

$$\frac{\tan 180^\circ - \theta'}{\tan 180^\circ - \theta} = \frac{-\frac{\beta}{\gamma C(v)}}{-\frac{\beta}{\gamma C(v)}} = -\frac{\beta}{\gamma C(v)} \left( -\frac{\gamma}{\beta} \right) = \frac{1}{C(v)} \quad (3.8)$$

Therefore

$$\tan \pi - \theta' = \frac{\tan \pi - \theta}{C(v)} \quad (3.9)$$

and consequently

$$\tan \theta' = \frac{\tan \theta}{C(v)} \quad (3.10)$$

or

$$\tan B' = \frac{\tan B}{C(v)} \quad (3.11)$$

which is the Angle Distortion Equation, where  $B'$  is the angle formed by a side travelling along the motion direction and another side which is oblique on the motion direction.

The angle  $\theta$  is increased {i.e.  $\theta' > \theta$ }.

$$\tan \varphi = \frac{\gamma}{\beta} \text{ and } \tan \varphi' = \frac{\gamma'}{\beta'} = \frac{\gamma \cdot v}{\beta} \quad (3.12)$$

whence:

$$\frac{\tan \varphi'}{\tan \varphi} = \frac{\frac{\gamma \cdot v}{\beta}}{\frac{\gamma}{\beta}} = \frac{\gamma \cdot v}{\beta} \cdot \frac{\beta}{\gamma} = v \quad (3.13)$$

So we get the following *Angle Distortion Equation*:

$$\tan \varphi' = \tan \varphi \cdot v \quad (3.14)$$

or

$$\tan C' = \tan C \cdot v \quad (3.15)$$

where  $\varphi$  is the angle formed by one side which is perpendicular on the motion direction and the other one is oblique to the motion direction.

The angle  $\varphi$  is decreased (i.e.  $\varphi' < \varphi$ ). If the traveling right triangle is oriented the opposite way

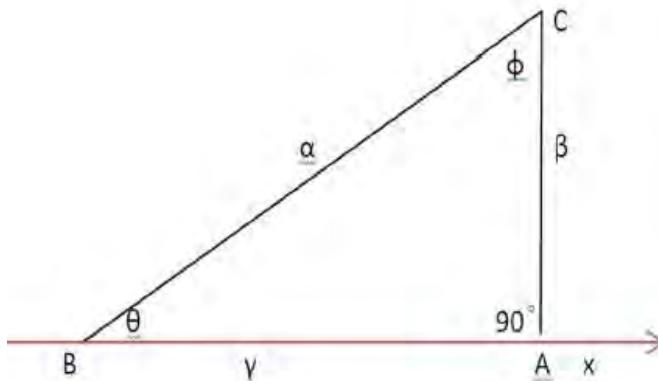


Fig. 3.3

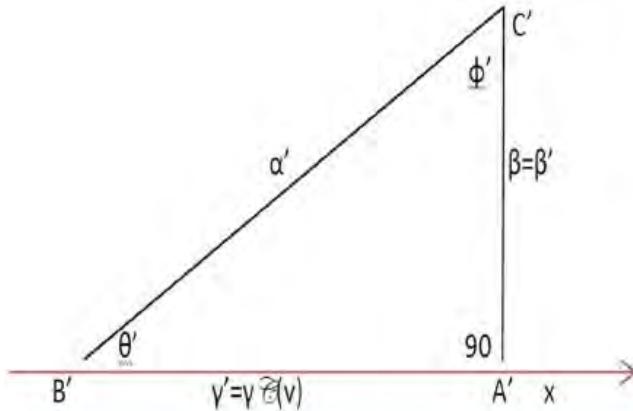
$$\tan \theta = \frac{\beta}{\gamma} \text{ and } \tan \varphi = \frac{\beta}{\gamma} \quad (3.16)$$

Similarly, after contraction of side  $AB$  (and consequently contraction of the oblique side  $BC$ ) one gets

$$\tan \theta' = \frac{\beta'}{\gamma'} = \frac{\beta}{\gamma v} \quad (3.17)$$

and

$$\tan \varphi' = \frac{\gamma'}{\beta'} = \frac{\gamma \mathcal{C} - v}{\beta} \quad (3.18)$$



*Fig. 3.4*

$$\frac{\tan \theta'}{\tan \theta} = \frac{\frac{\beta}{\gamma \mathcal{C} - v}}{\frac{\beta}{\gamma}} = \frac{1}{\mathcal{C} - v} \quad (3.19)$$

or

$$\tan \theta' = \frac{\tan \theta}{\mathcal{C} v} \quad (3.20)$$

and similarly

$$\frac{\tan \varphi'}{\tan \varphi} = \frac{\frac{\gamma \mathcal{C} v}{\beta}}{\frac{\gamma}{\beta}} = \mathcal{C} v \quad (3.21)$$

or

$$\tan \varphi' = \tan \varphi \cdot \mathcal{C} v \quad (3.22)$$

Therefore, one got the same Angle Distortion Equations for a right triangle traveling with one of its legs along the motion direction.

### 3.3. Tangential Relations between Distorted Angles vs. Original Angles of a General Triangle

Let's suppose a general triangle  $\Delta ABC$  is travelling at speed  $v$  along the side  $BC$  as bellow

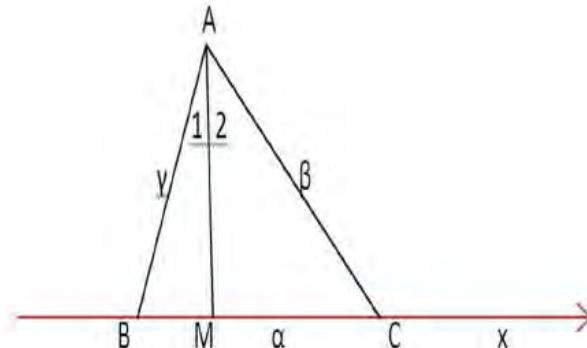


Fig. 3.5

The height remains not contracted:  $AM \equiv A'M'$ .

We can split this figure into two traveling right sub-triangles as bellow:

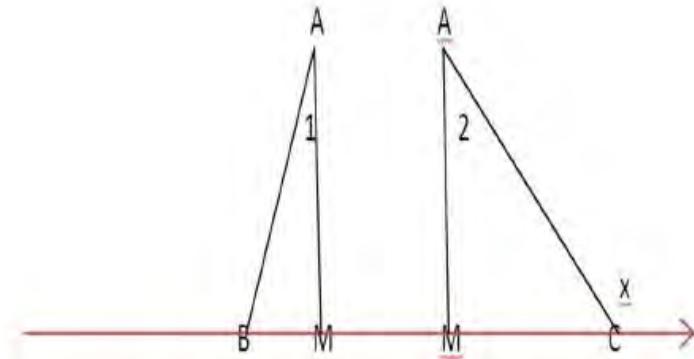


Fig. 3.6

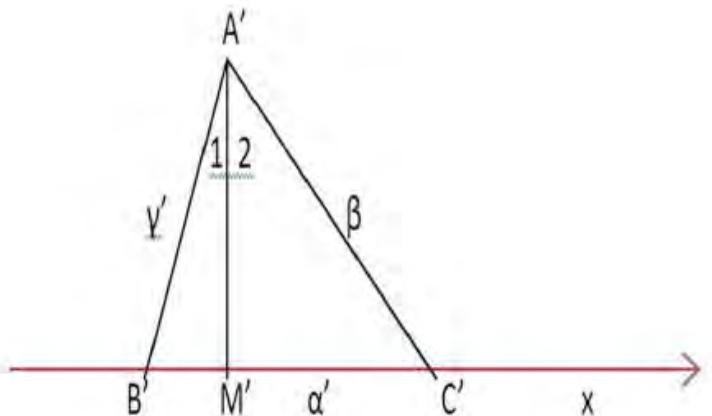


Fig. 3.7

Similarly, we can split this figure into two traveling right sub-triangles as below:

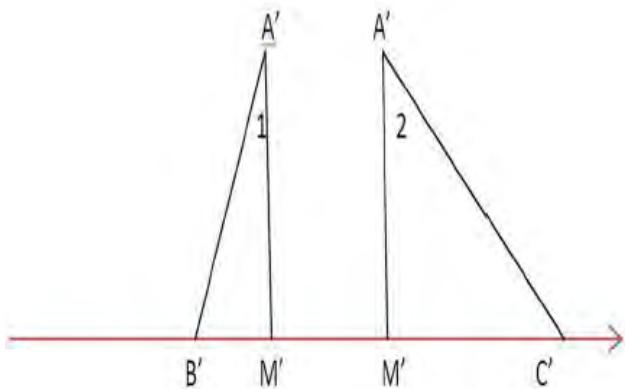


Fig. 3.8

In the right triangles  $\Delta A'M'B'$  and respectively  $\Delta A'M'C'$  one has

$$\tan B' = \frac{\tan B}{C(v)} \text{ and } \tan C' = \frac{\tan C}{C(v)} \quad (3.23)$$

Also

$$\tan A'_1 = \tan A_1 C(v) \text{ and } \tan A'_2 = \tan A_2 C(v) \quad (3.24)$$

But

$$\begin{aligned} \tan A' &= \tan(A'_1 + A'_2) = \frac{\tan A'_1 + \tan A'_2}{1 - \tan A'_1 \tan A'_2} \\ &= \frac{\tan A_1 C(v) + \tan A_2 C(v)}{1 - \tan A_1 C(v) \tan A_2 C(v)} \\ &= C(v) \cdot \frac{\tan A_1 + \tan A_2}{1 - \tan A_1 \tan A_2 C(v)^2} \\ &= C(v) \cdot \frac{\tan A_1 + \tan A_2}{1 - \tan A_1 \tan A_2} \cdot \frac{(1 - \tan A_1 \tan A_2)}{1 - \tan A_1 \tan A_2 C(v)^2} \\ &= C(v) \cdot \frac{\tan(A_1 + A_2)}{1} \cdot \frac{1 - \tan A_1 \tan A_2}{1 - \tan A_1 \tan A_2 C(v)^2}. \end{aligned} \quad (3.25)$$

We got

$$\tan A' = \tan A \cdot v \cdot \frac{1 - \tan A_1 \tan A_2}{1 - \tan A_1 \tan A_2 v^2} \quad (3.26)$$

### 3.4. Other Relations between the Distorted Angles and the Original Angles

- A) Another relation uses the Law of Sine in the triangles  $\Delta ABC$  and respectively  $\Delta A'B'C'$ :

$$\frac{\alpha}{\sin A} = \frac{\beta}{\sin B} = \frac{\gamma}{\sin C} \quad (3.27)$$

$$\frac{\alpha'}{\sin A'} = \frac{\beta'}{\sin B'} = \frac{\gamma'}{\sin C'} \quad (3.28)$$

After substituting

$$\alpha' = \alpha \cdot v \quad (3.29)$$

$$\beta' = \beta \cdot v \cdot C \quad (3.30)$$

$$\gamma' = \gamma \cdot v \cdot B \quad (3.31)$$

into the second relation one gets:

$$\frac{\alpha \cdot v}{\sin A'} = \frac{\beta \cdot v \cdot C}{\sin B'} = \frac{\gamma \cdot v \cdot B}{\sin C'} \quad (3.32)$$

Then we divide term by term the previous equalities:

$$\frac{\frac{\alpha}{\sin A}}{\frac{\alpha \cdot v}{\sin A'}} = \frac{\frac{\beta}{\sin B}}{\frac{\beta \cdot v \cdot C}{\sin B'}} = \frac{\frac{\gamma}{\sin C}}{\frac{\gamma \cdot v \cdot B}{\sin C'}} \quad (3.33)$$

whence one has:

$$\frac{\sin A'}{\sin A \cdot \mathcal{C} v} = \frac{\sin B'}{\sin B \cdot \mathcal{C} v, C} = \frac{\sin C'}{\sin C \cdot \mathcal{C} v, B}. \quad (3.34)$$

B) Another way:

$$A' = 180^\circ - B' + C' \quad \text{and} \quad A = 180^\circ - B + C \quad (3.35)$$

$$\begin{aligned} \tan A' &= \tan [180^\circ - B' + C'] = -\tan(B' + C') = -\frac{\tan B' + \tan C'}{1 - \tan B' \tan C'} = \\ &= -\frac{\frac{\tan B}{\mathcal{C} v} + \frac{\tan C}{\mathcal{C} v}}{1 - \tan B \cdot \tan C \cdot \mathcal{C} v^2} = -\frac{1}{\mathcal{C} v} \cdot \frac{\tan B + \tan C}{1 - \tan B \cdot \tan C \cdot \mathcal{C} v^2} = \\ &= -\frac{\frac{\tan B + C}{\mathcal{C} v} \cdot \frac{1 - \tan B \tan C}{1 - \tan B \tan C \mathcal{C} v^2}}{1 - \tan B \tan C \mathcal{C} v^2} = \\ &= -\frac{-\tan[180^\circ - B + C]}{\mathcal{C} v} \cdot \frac{1 - \tan B \tan C}{1 - \tan B \tan C \mathcal{C} v^2} = \\ &= \frac{\tan A}{\mathcal{C} v} \cdot \frac{1 - \tan B \cdot \tan C}{1 - \tan B \cdot \tan C \cdot \mathcal{C} v^2} \end{aligned} \quad (3.36)$$

We got

$$\tan A' = \frac{\tan A}{\mathcal{C} v} \cdot \frac{1 - \tan B \cdot \tan C}{1 - \tan B \cdot \tan C \cdot \mathcal{C} v^2} \quad (3.37)$$

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Originally published in PROGRESS IN PHYSICS, Volume 3 (2013), Issue 3 (July), p. 21-24. Reviewed.

## 4. n-Valued Refined Neutrosophic Logic and Its Applications to Physics

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We present a short history of logics: from particular cases of 2-symbol or numerical valued logic to the general case of n-symbol or numerical valued logic.

We show generalizations of 2-valued Boolean logic to fuzzy logic, also from the Kleene's and Lukasiewicz' 3-symbol valued logics or Belnap's 4-symbol valued logic to the most general *n-symbol or numerical valued refined neutrosophic logic*.

Two classes of neutrosophic norm (*n-norm*) and neutrosophic conorm (*n-conorm*) are defined. Examples of applications of neutrosophic logic to physics are listed in the last section. Similar generalizations can be done for n-Valued Refined Neutrosophic Set, and respectively n-Valued Refined Neutrosophic Probability.

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### 4.1. Two-Valued Logic

#### 4.1.1. The Two Symbol-Valued Logic

It is the Chinese philosophy: *Yin and Yang* (or Femininity and Masculinity) as contraries:



*Fig. 4.1*

It is also the Classical or *Boolean Logic*, which has two symbol-values: truth T and falsity F.

#### **4.1.2. The Two Numerical-Valued Logic**

It is also the Classical or Boolean Logic, which has two numerical-values: truth 1 and falsity 0. More general it is the *Fuzzy Logic*, where the truth ( $T$ ) and the falsity ( $F$ ) can be any numbers in  $[0,1]$  such that  $T + F = 1$ .

Even more general,  $T$  and  $F$  can be subsets of  $[0,1]$ .

### **4.2. Three-Valued Logic**

#### **4.2.1. The Three Symbol-Valued Logics**

1. *Lukasiewicz's Logic*: True, False, and Possible.
2. *Kleene's Logic*: True, False, Unknown (or Undefined).
3. Chinese philosophy extended to: Yin, Yang, and Neuter (or Femininity, Masculinity, and Neutrality) - as in Neutrosophy.

*Neutrosophy* philosophy was born from neutrality between various philosophies. Connected with *Extenics* (Prof. Cai Wen, 1983), and *Paradoxism* (F. Smarandache, 1980). Neutrosophy is a new branch of philosophy that

studies the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra.

This theory considers every notion or idea  $\langle A \rangle$  together with its opposite or negation  $\langle \text{anti}A \rangle$  and with their spectrum of neutralities  $\langle \text{neut}A \rangle$  in between them (i.e. notions or ideas supporting neither  $\langle A \rangle$  nor  $\langle \text{anti}A \rangle$ ). The  $\langle \text{neut}A \rangle$  and  $\langle \text{anti}A \rangle$  ideas together are referred to as non  $A$ .

Neutrosophy is a generalization of Hegel's dialectics (the last one is based on  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$  only). According to this theory every idea  $\langle A \rangle$  tends to be neutralized and balanced by  $\langle \text{anti}A \rangle$  and  $\langle \text{non}A \rangle$  ideas - as a state of equilibrium. In a classical way  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ ,  $\langle \text{anti}A \rangle$  are disjoint two by two. But, since in many cases the borders between notions are vague, imprecise, Sorites, it is possible that  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ ,  $\langle \text{anti}A \rangle$  (and  $\langle \text{non}A \rangle$  of course) have common parts two by two, or even all three of them as well.

*Such contradictions involve Extenics.* Neutrosophy is the base of all neutrosophics and it is used in engineering applications (especially for software and information fusion), medicine, military, airspace, cybernetics, physics.

#### 4.2.2. The Three Numerical-Valued Logic

1. *Kleene's Logic:* True (1), False (0), Unknown (or Undefined) (1/2), and uses "min" for  $\wedge$ , "max" for  $\vee$ , and " $\neg$ " for negation.

2. More general is the *Neutrosophic Logic* [Smarandache, 1995], where the truth ( $T$ ) and the falsity ( $F$ ) and the indeterminacy ( $I$ ) can be any numbers in  $[0, 1]$ , then  $0 \leq T + I + F \leq 3$ . More general: Truth ( $T$ ), Falsity

(*F*), and Indeterminacy (*I*) are standard or nonstandard subsets of the nonstandard interval  $]^{-}0, 1^{+}[$ .

## 4.3 Four-Valued Logic

### 4.3.1 The Four Symbol-Valued Logic

1. It is *Belnap's Logic*: True (*T*), False (*F*), Unknown (*U*), and Contradiction (*C*), where *T*, *F*, *U*, *C* are symbols, not numbers. Below is the Belnap's conjunction operator table:

$\cap$	<i>F</i>	<i>U</i>	<i>C</i>	<i>T</i>
<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>
<i>U</i>	<i>F</i>	<i>U</i>	<i>F</i>	<i>U</i>
<i>C</i>	<i>F</i>	<i>F</i>	<i>C</i>	<i>C</i>
<i>T</i>	<i>F</i>	<i>U</i>	<i>C</i>	<i>T</i>

*Fig. 4.2*

Restricted to *T*, *F*, *U*, and to *T*, *F*, *C*, the Belnap connectives coincide with the connectives in Kleene's logic.

2. Let *G* = *Ignorance*. We can also propose the following two 4-Symbol Valued Logics: (*T*, *F*, *U*, *G*), and (*T*, *F*, *C*, *G*).

3. *Absolute-Relative 2-, 3-, 4-, 5-, or 6-Symbol Valued Logics* [Smarandache, 1995]. Let *T<sub>A</sub>* be truth in all possible worlds (according to Leibniz's definition); *T<sub>R</sub>* be truth in at last one world but not in all worlds; and similarly let *I<sub>A</sub>* be indeterminacy in all possible worlds; *I<sub>R</sub>* be indeterminacy in at last one world but not in all worlds; also let *F<sub>A</sub>* be

falsity in all possible worlds;  $F_R$  be falsity in at last one world but not in all worlds; Then we can form several Absolute-Relative 2-, 3-, 4-, 5-, or 6-Symbol Valued Logics just taking combinations of the symbols  $T_A, T_R, I_A, I_R, F_A$ , and  $F_R$ . As particular cases, very interesting would be to study the Absolute Relative 4-Symbol Valued Logic (symbols  $T_A, T_R, F_A, F_R$ ), as well as the Absolute-Relative 6-Symbol Valued Logic ( $T_A, T_R, I_A, I_R, F_A, F_R$ ).

#### 4.3.2 Four Numerical-Valued Neutrosophic Logic

Indeterminacy  $I$  is refined (split) as  $U$  = Unknown, and  $C$  = contradiction.  $T, F, U, C$  are subsets of  $[0, 1]$ , instead of symbols; This logic generalizes Belnap's logic since one gets a degree of truth, a degree of falsity, a degree of unknown, and a degree of contradiction. Since  $C = T \wedge F$ , this logic involves the Extenics.

### 4.4. Five-Valued Logic

1. *Five Symbol-Valued Neutrosophic Logic* [Smarandache, 1995]: Indeterminacy  $I$  is refined (split) as  $U$  = Unknown,  $C$  = contradiction, and  $G$  = ignorance; where the symbols represent:

$T$  = truth;

$F$  = falsity;

$U$  = neither  $T$  nor  $F$  (undefined);

$C = T \wedge F$ , which involves the Extenics;

$G = T \vee F$ .

2. If  $T, F, U, C, G$  are subsets of  $[0, 1]$  then we get: a *Five Numerical-Valued Neutrosophic Logic*.

## 4.5. Seven-Valued Logic

1. Seven Symbol-Valued Neutrosophic Logic [Smarandache, 1995]:  $I$  is refined (split) as  $U, C, G$ , but  $T$  also is refined as  $T_A =$  absolute truth and  $T_R =$  relative truth, and  $F$  is refined as  $F_A =$  absolute falsity and  $F_R =$  relative falsity, where:

$$U = \text{neither } (T_A \text{ or } T_R) \text{ nor } (F_A \text{ or } F_R) \text{ (i.e. undefined);}$$

$C = (T_A \text{ or } T_R) \wedge (F_A \text{ or } F_R)$  (i.e. Contradiction), which involves the Extenics;

$$G = (T_A \text{ or } T_R) \vee (F_A \text{ or } F_R) \text{ (i.e. Ignorance).}$$

All are symbols.

2. But if  $T_A, T_R, F_A, F_R, U, C, G$  are subsets of  $[0, 1]$ , then we get a Seven Numerical-Valued Neutrosophic Logic.

## 4.6. n-Valued Logic

### 4.6.1. n-Symbol-Valued Refined Neutrosophic Logic

In general [Smarandache, 1995]:  $T$  can be split into many types of truths:  $T_1, T_2, \dots, T_p$ , and  $I$  into many types of indeterminacies:  $I_1, I_2, \dots, I_r$ , and  $F$  into many types of falsities:  $F_1, F_2, \dots, F_s$ , where all  $p, r, s \geq 1$  are integers, and  $p + r + s = n$ . All subcomponents  $T_j, I_k, F_l$  are symbols for  $j \in \{1, 2, \dots, p\}, k \in \{1, 2, \dots, r\}$ , and  $l \in \{1, 2, \dots, s\}$ .

If at least one  $I_k = T_j \wedge F_l =$  contradiction, we get again the Extenics.

### 4.6.2. n-Numerical-Valued Refined Neutrosophic Logic

In the same way, but all subcomponents  $T_j, I_k, F_l$  are not symbols, but subsets of  $[0, 1]$ , for all  $j \in \{1, 2, \dots, p\}$ , for all  $k \in \{1, 2, \dots, r\}$ , and for all  $l \in \{1, 2, \dots, s\}$ . If all sources of information that separately provide neutrosophic values

for a specific subcomponent are independent sources, then in the general case we consider that each of the subcomponents  $T_j, I_k, F_l$  is independent with respect to the others and it is in the non-standard set  $]^{-}0; 1^{+}[$ .

Therefore, per total, we have for crisp neutrosophic value subcomponents  $T_j, I_k, F_l$ , that:

$$^{-}0 \leq \sum_{j=1}^p T_j + \sum_{k=1}^r I_k + \sum_{l=1}^s F_l \leq n^{+} \quad (4.1)$$

where of course  $n = p + r + s$  as above. If there are some dependent sources (or respectively some dependent subcomponents), we can treat those dependent subcomponents together. For example, if  $T_2$  and  $I_3$  are dependent, we put them together as  $^{-}0 \leq T_2 + I_3 \leq 1^{+}$ .

The non-standard unit interval  $\Phi\Box;1+[$ , used to make a distinction between absolute and relative truth/indeterminacy/falsehood in philosophical applications, is replaced for simplicity with the standard (classical) unit interval  $]^{-}0, 1^{+}[$  for technical applications.

For at least one  $I_k = T_j \wedge F_l$  = contradiction, we get again the Extenics.

## 4.7. n-Valued Neutrosophic Logic Connectors

### 4.7.1. n-norm and n-conorm defined on combinations of t-norm and t-conorm

The *n-norm* is actually the neutrosophic conjunction operator, NEUTROSOPHIC AND ( $\wedge n$ ); while the *n-conorm* is the neutrosophic disjunction operator, NEUTROSOPHIC OR ( $\vee n$ ).

One can use the *t-norm* and *t-conorm* operators from the fuzzy logic in order to define the ***n-norm*** and respectively ***n-conorm*** in neutrosophic logic:

$$\begin{aligned}
 & n - norm((T_j)_{j=\{1,2,\dots,p\}}, \\
 & (I_k)_{k=\{1,2,\dots,r\}}, (F_l)_{l=\{1,2,\dots,s\}}) \\
 & = ([t - norm(T_j)]_{j=\{1,2,\dots,p\}}, \\
 & [t - conorm(I_k)]_{k=\{1,2,\dots,r\}}, \\
 & [t - conorm(F_l)]_{l=\{1,2,\dots,s\}}) \tag{4.2}
 \end{aligned}$$

and

$$\begin{aligned}
 & n - conorm((T_j)_{j=\{1,2,\dots,p\}}, (I_k)_{k=\{1,2,\dots,r\}}, \\
 & (F_l)_{l=\{1,2,\dots,s\}}) \\
 & = ([t - conorm(T_j)]_{j=\{1,2,\dots,p\}}, \\
 & [t - norm(I_k)]_{k=1,2,\dots,r}, \\
 & [t - norm(F_l)]_{l=1,2,\dots,s}) \tag{4.3}
 \end{aligned}$$

and then one normalizes if needed.

Since the *n-norms/n-conorms*, alike *t-norms/t-conorms*, can only approximate the inter-connectivity between two *n-Valued Neutrosophic Propositions*, there are many versions of these approximations.

For example, for the *n-norm*: the indeterminate (sub)components  $I_k$  alone can be combined with the *t-conorm* in a pessimistic way [i.e. ***lower bound***], or with the *t-norm* in an optimistic way [***upper bound***]; while for the *n-conorm*: the indeterminate (sub)components  $I_k$  alone can be combined with the *t-norm* in a pessimistic way [i.e. ***lower bound***], or with the *t-conorm* in an optimistic way [***upper bound***].

In general, if one uses in defining an *n-norm/n-conorm* for example the *t-norm*  $\min\{x, y\}$ , then it is

indicated that the corresponding *t-conorm* used be  $\max\{x, y\}$ ; or if the *t-norm* used is the product  $xy$ , then the corresponding *t-conorm* should be  $x + y - xy$ ; and similarly if the *t-norm* used is  $\max\{0, x + y - 1\}$ , then the corresponding *t-conorm* should be  $\min\{x + y, 1\}$ ; and so on.

Yet, it is still possible to define the *n-norm* and *n-conorm* using different types of *t-norms* and *t-conorms*.

#### 4.7.2. n-norm and n-conorm based on priorities

For the *n-norm* we can consider the priority:  $T < I < F$ , where the subcomponents are supposed to conform with similar priorities, i.e.

$$\begin{aligned} T_1 &< T_2 < \dots < T_p < I_1 < I_2 < \dots \\ &< I_r < F_1 < F_2 < \dots < F_s. \end{aligned} \quad (4.4)$$

While for the *n-conorm* one has the opposite priorities:  $T > I > F$ , or for the refined case:

$$\begin{aligned} T_1 &> T_2 > \dots > T_p > I_1 > I_2 > \dots \\ &> I_r > F_1 > F_2 > \dots > F_s. \end{aligned} \quad (4.5)$$

By definition  $A < B$  means that all products between A and B go to B (the bigger).

Let's say, one has two neutrosophic values in simple (non-refined case):

$$(T_x; I_x; F_x) \quad (4.6)$$

and

$$(T_y; I_y; F_y) \quad (4.7)$$

Applying the *n-norm* to both of them, with priorities  $T < I < F$ , we get:

$$\begin{aligned} & (T_x, I_x, F_x) \wedge_n (T_y, I_y, F_y) \\ &= (T_x T_y, T_x I_y + T_y I_x + I_x I_y, \\ & \quad T_x F_y + T_y F_x + I_x F_y + I_y F_x + F_x F_y). \end{aligned} \tag{4.8}$$

Applying the  $n$ -conorm to both of them, with priorities  $T > I > F$ , we get:

$$\begin{aligned} & (T_x, I_x, F_x) \vee_n (T_y, I_y, F_y) \\ &= (T_x T_y + T_x I_y + T_y I_x + T_x F_y + T_y F_x, \\ & \quad I_x I_y + I_x F_y + I_y F_x, F_x F_y). \end{aligned} \tag{4.9}$$

In a *lower bound (pessimistic)*  $n$ -norm one considers the priorities  $T < I < F$ , while in *an upper bound (optimistic)*  $n$ -norm one considers the priorities  $I < T < F$ .

Whereas, in *an upper bound (optimistic)*  $n$ -conorm one considers  $T > I > F$ , while in *a lower bound (pessimistic)*  $n$ -conorm one considers the priorities  $T > F > I$ .

Various priorities can be employed by other researchers depending on each particular application.

## 4.8. Particular Cases

If in 4.6.1. and 4.6.2., one has all  $I_k = 0, k = \{1, 2, \dots, r\}$ , we get the *n-Valued Refined Fuzzy Logic*.

If in 4.6.1. and 4.6.2., one has only one type of indeterminacy, i.e.  $k = 1$ , hence  $I_1 = I > 0$ , we get the *n-Valued Refined Intuitionistic Fuzzy Logic*.

## 4.9. Distinction between Neutrosophic Physics and Paradoxist Physics

Firstly, we make a distinction between *Neutrosophic Physics* and *Paradoxist Physics*.

#### 4.9.1. Neutrosophic Physics

Let  $\langle A \rangle$  be a physical entity (i.e. concept, notion, object, space, field, idea, law, property, state, attribute, theorem, theory, etc.),  $\langle \text{anti}A \rangle$  be the opposite of  $\langle A \rangle$ , and  $\langle \text{neut}A \rangle$  be their neutral (i.e. neither  $\langle A \rangle$  nor  $\langle \text{anti}A \rangle$ , but in between).

*Neutrosophic Physics* is a mixture of two or three of these entities  $\langle A \rangle$ ,  $\langle \text{anti}A \rangle$ , and  $\langle \text{neut}A \rangle$  that hold together. Therefore, we can have *neutrosophic fields*, and *neutrosophic objects*, *neutrosophic states*, etc.

#### 4.9.2. Paradoxist Physics

*Neutrosophic Physics* is an extension of *Paradoxist Physics*, since *Paradoxist Physics* is a combination of physical contradictions  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$  only that hold together, without referring to their neutrality  $\langle \text{neut}A \rangle$ . *Paradoxist Physics* describes collections of objects or states that are individually characterized by contradictory properties, or are characterized neither by a property nor by the opposite of that property, or are composed of contradictory sub-elements. Such objects or states are called *paradoxist entities*.

These domains of research were set up in the 1995 within the frame of neutrosophy, neutrosophic logic/set/probability/statistics.

### 4.10. n-Valued Refined Neutrosophic Logic Applied to Physics

There are many cases in the scientific (and also in humanistic) fields that two or three of these items  $\langle A \rangle$ ,  $\langle \text{anti}A \rangle$ , and  $\langle \text{neut}A \rangle$  simultaneously coexist.

#### **4.10.1. Examples of paradoxist and neutrosophic entities**

- Anions in two spatial dimensions are arbitrary spin particles that are neither bosons (integer spin) nor fermions (half integer spin);
- among possible Dark Matter candidates there may be exotic particles that are neither Dirac nor Majorana fermions;
- mercury (Hg) is a state that is neither liquid nor solid under normal conditions at room temperature;
- non-magnetic materials are neither ferromagnetic nor anti-ferromagnetic;
- quark gluon plasma (QGP) is a phase formed by quasifree quarks and gluons that behaves neither like a conventional plasma nor as an ordinary liquid;
- unmatter, which is formed by matter and antimatter that bind together (F. Smarandache, 2004);
- neutral kaon, which is a pion and anti-pion composite (R. M. Santilli, 1978) and thus a form of unmatter;
- neutrosophic methods in General Relativity (D. Rabounski, F. Smarandache, L. Borissova, 2005);
- neutrosophic cosmological model (D. Rabounski, L. Borissova, 2011);
- neutrosophic gravitation (D. Rabounski);

- qubit and generally quantum superposition of states;
- semiconductors are neither conductors nor isolators;
- semi-transparent optical components are neither opaque nor perfectly transparent to light;
- quantum states are metastable (neither perfectly stable, nor unstable);
- neutrino-photon doublet (E. Goldfain);
- the “multiplet” of elementary particles is a kind of “neutrosophic field” with two or more values (E. Goldfain, 2011);
- a “neutrosophic field” can be generalized to that of operators whose action is selective. The effect of the neutrosophic field is somehow equivalent with the “tunneling” from the solid physics, or with the “spontaneous symmetry breaking” (SSB) where there is an internal symmetry which is broken by a particular selection of the vacuum state (E. Goldfain). Etc.

## 4.11. Conclusion

Many types of logics have been presented above. For the most general logic, the *n-valued refined neutrosophic logic*, we presented two classes of neutrosophic operators to be used in combinations of neutrosophic valued propositions in physics.

Similar generalizations are done for *n-Valued Refined Neutrosophic Set*, and respectively *n-Valued Refined Neutrosophic Probability*.

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Originally published in PROGRESS IN PHYSICS,  
Volume 4 (2013), Issue 4 (October), p. 143-146. Reviewed.

## 5. Neutrosophic Diagram and Classes of Neutrosophic Paradoxes or to the Outer-Limits of Science

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These paradoxes are called “neutrosophic” since they are based on indeterminacy (or neutrality, i.e. neither true nor false), which is the third component in neutrosophic logic. We generalize the Venn diagram to a Neutrosophic Diagram, which deals with vague, inexact, ambiguous, ill-defined ideas, statements, notions, entities with unclear borders. We define the neutrosophic truth table, then we introduce two neutrosophic operators (neuterization and antonymization operators), and give many classes of neutrosophic paradoxes.

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### 5.1. Introduction to the neutrosophics

Let  $\langle A \rangle$  be an idea, or proposition, statement, attribute, theory, event, concept, entity, and  $\langle \text{non}A \rangle$  what is not  $\langle A \rangle$ . Let  $\langle \text{anti}A \rangle$  be the opposite of  $\langle A \rangle$ . We have introduced a new notation [1998],  $\langle \text{neut}A \rangle$ , which is neither  $\langle A \rangle$  nor  $\langle \text{anti}A \rangle$  but in between.  $\langle \text{neut}A \rangle$  is related with  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$ .

Let's see an example for vague (not exact) concepts: if  $\langle A \rangle$  is “*tall*” (an attribute), then  $\langle \text{anti } A \rangle$  is “*short*”, and  $\langle \text{neut } A \rangle$  is “*medium*”, while  $\langle \text{non } A \rangle$  is “*not tall*” (which can be “*medium or short*”). Similarly, for other  $\langle A \rangle$ ,  $\langle \text{neut } A \rangle$ ,  $\langle \text{anti } A \rangle$  such as:  $\langle \text{good} \rangle$ ,  $\langle \text{so and so} \rangle$ ,  $\langle \text{bad} \rangle$ , or  $\langle \text{perfect} \rangle$ ,  $\langle \text{average} \rangle$ ,  $\langle \text{imperfect} \rangle$ , or  $\langle \text{high} \rangle$ ,  $\langle \text{medium} \rangle$ ,  $\langle \text{small} \rangle$ , or respectively  $\langle \text{possible} \rangle$ ,  $\langle \text{sometimes possible and other times impossible} \rangle$ ,  $\langle \text{impossible} \rangle$ , etc.

Now, let's take an exact concept / statement: if  $\langle A \rangle$  is the statement “ $1 + 1 = 2$  in base 10”, then  $\langle \text{anti } A \rangle$  is “ $1 + 1 \neq 2$  in base 10”, while  $\langle \text{neut } A \rangle$  is undefined (doesn't exist) since it is not possible to have a statement in between “ $1 + 1 = 2$  in base 10” and “ $1 + 1 \neq 2$  in base 10” because in base 10 we have  $1 + 1$  is either equal to 2 or  $1 + 1$  is different from 2.  $\langle \text{non } A \rangle$  coincides with  $\langle \text{anti } A \rangle$  in this case,  $\langle \text{non } A \rangle$  is “ $1 + 1 \neq 2$  in base 10”.

Neutrosophy is a theory the author developed since 1995 as a generalization of dialectics. This theory considers every notion or idea  $\langle A \rangle$  together with its opposite or negation  $\langle \text{anti } A \rangle$ , and the spectrum of “neutralities” in between them and related to them, noted by  $\langle \text{neut } A \rangle$ .

*The Neutrosophy* is a new branch of philosophy which studies the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra.

*Its Fundamental Thesis:* Any idea  $\langle A \rangle$  is  $T\%$  true,  $I\%$  indeterminate (i.e. neither true nor false, but neutral, unknown), and  $F\%$  false.

*Its Fundamental Theory:* Every idea  $\langle A \rangle$  tends to be neutralized, diminished, balanced by  $\langle \text{non}A \rangle$  ideas (not only by  $\langle \text{anti}A \rangle$  as Hegel asserted) — as a state of equilibrium.

In between  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$  there may be a continuous spectrum of particular  $\langle \text{neut}A \rangle$  ideas, which can balance  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$ .

To neuter an idea one must discover all its three sides: of sense (truth), of nonsense (falsity), and of undecidability (indeterminacy) - then reverse/combine them. Afterwards, the idea will be classified as neutrality.

There exists a *Principle of Attraction* not only between the opposites  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$  (as in dialectics), but also between them and their neutralities  $\langle \text{neut}A \rangle$  related to them, since  $\langle \text{neut}A \rangle$  contributes to the *Completeness of Knowledge*.

Hence, neutrosophy is based not only on analysis of oppositional propositions as dialectic does, but on analysis of these contradictions together with the neutralities related to them.

Neutrosophy was extended to Neutrosophic Logic, Neutrosophic Set, Neutrosophic Probability and Neutrosophic Statistics, which are used in technical applications.

In the Neutrosophic Logic (which is a generalization of fuzzy logic, especially of intuitionistic fuzzy logic) every logical variable  $x$  is described by an ordered triple  $x = (T, I, F)$ , where  $T$  is the degree of truth,  $F$  is the degree of falsehood, and  $I$  the degree of indeterminacy (or neutrality,

i.e. neither true nor false, but vague, unknown, imprecise), with  $T, I, F$  standard or non-standard subsets of the non-standard unit interval  $]^{-}0; 1^{+}[$ . In addition, these values may vary over time, space, hidden parameters, etc.

*Neutrosophic Probability* (as a generalization of the classical probability and imprecise probability) studies the chance that a particular event  $\langle A \rangle$  will occur, where that chance is represented by three coordinates (variables):  $T\%$  chance the event will occur,  $I\%$  indeterminate (unknown) chance, and  $F\%$  chance the event will not occur.

*Neutrosophic Statistics* is the analysis of neutrosophic probabilistic events.

*Neutrosophic Set* (as a generalization of the fuzzy set, and especially of intuitionistic fuzzy set) is a set such that an element belongs to the set with a neutrosophic probability, i.e.  $T$  degree of appurtenance (membership) to the set,  $I$  degree of indeterminacy (unknown if it is appurtenance or nonappurtenance to the set), and  $F$  degree of non-appurtenance (non-membership) to the set.

There exist, for each particular idea: PRO parameters, CONTRA parameters, and NEUTER parameters which influence the above values. Indeterminacy results from any hazard which may occur, from unknown parameters, or from new arising conditions. This resulted from practice.

## 5.2. Applications of neutrosophics

Neutrosophic logic/set/probability/statistics are useful in artificial intelligence, neural networks, evolutionary programming, neutrosophic dynamic systems, and quantum mechanics.

### 5.3. Examples of neutrosophy used in Arabic philosophy

- While Avicenna promotes the idea that the world is contingent if it is necessitated by its causes, Averroes rejects it, and both of them are right from their point of view. Hence  $\langle A \rangle$  and  $\langle \text{anti } A \rangle$  have common parts.
- Islamic dialectical theology (*kalam*) promoting creationism was connected by Avicenna in an extraordinary way with the opposite Aristotelian-Neoplatonic tradition. Actually a lot of work by Avicenna falls into the frame of neutrosophy.
- Averroes's religious judges (*qadis*) can be connected with atheists' believes.
- al-Farabi's metaphysics and general theory of emanation vs. al-Ghazali's Sufi writings and mystical treatises [we may think about a coherence of al-Ghazali's "Incoherence of the Incoherence" book].
- al-Kindi's combination of Koranic doctrines with Greek philosophy.
- Islamic Neoplatonism + Western Neoplatonism.
- Ibn-Khaldun's statements in his theory on the cyclic sequence of civilizations, says that: Luxury leads to the raising of civilization (because the people seek for comforts of life) but also Luxury leads to the decay of civilization (because its correlation with the corruption of ethics).

- On the other hand, there's the method of absent-by-present syllogism in jurisprudence, in which we find the same principles and laws of neutrosophy.
- In fact, we can also function a lot of Arabic aphorisms, maxims, Koranic miracles (Ayat Al-Qur'an) and Sunna of the prophet, to support the theory of neutrosophy. Take the colloquial proverb that "The continuance of state is impossible" too, or "Everything, if it's increased over its extreme, it will turn over to its opposite"!

#### 5.4. The Venn diagram

In a Venn diagram we have with respect to a universal set  $U$  the following:

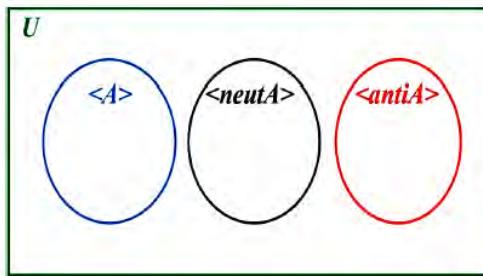


Fig. 5.1. Venn diagram

Therefore, there are no common parts amongst  $\langle A \rangle$ ,  $\langle neutA \rangle$ , and  $\langle antiA \rangle$ , and all three of them are (completely) contained by the universal set  $U$ . Also, all borders of these sets  $\langle A \rangle$ ,  $\langle neutA \rangle$ ,  $\langle antiA \rangle$ , and  $U$  are clear, exact.

All these four sets are well-defined. While  $\langle neutA \rangle$  means neutralities related to  $\langle A \rangle$  and  $\langle antiA \rangle$ , what is outside of  $\langle A \rangle \cup \langle neutA \rangle \cup \langle antiA \rangle$  but inside of  $U$  are other neutralities, not related to  $\langle A \rangle$  or to  $\langle antiA \rangle$ .

Given  $\langle A \rangle$ , there are two types of neutralities: those related to  $\langle A \rangle$  (and implicitly related to  $\langle antiA \rangle$ ), and those not related to  $\langle A \rangle$  (and implicitly not related to  $\langle antiA \rangle$ ).

## 5.5. The neutrosophic diagram, as extension of the Venn diagram

Yet, for ambiguous, vague, not-well-known (or even unknown) imprecise ideas / notions / statements / entities with unclear frontiers amongst them the below relationships may occur because between an approximate idea noted by  $\langle A \rangle$  and its opposite  $\langle antiA \rangle$  and their neutralities  $\langle neutA \rangle$  there are not clear delimitations, not clear borders to distinguish amongst what is  $\langle A \rangle$  and what is not  $\langle A \rangle$ . There are buffer zones in between  $\langle A \rangle$  and  $\langle antiA \rangle$  and  $\langle neutA \rangle$ , and an element  $x$  from a buffer zone between  $\langle A \rangle$  and  $\langle antiA \rangle$  may or may not belong to both  $\langle A \rangle$  and  $\langle antiA \rangle$  simultaneously. And similarly for an element  $y$  in a buffer zone between  $\langle A \rangle$  and  $\langle neutA \rangle$ , or an element  $z$  in the buffer zone between  $\langle neutA \rangle$  and  $\langle antiA \rangle$ . We may have a buffer zone where the confusion of appurtenance to  $\langle A \rangle$ , or to  $\langle neutA \rangle$ , or to  $\langle antiA \rangle$  is so high, that we can consider that an element  $w$  belongs to all of them simultaneously (or to none of them simultaneously).

We say that all four sets  $\langle A \rangle$ ,  $\langle neutA \rangle$ ,  $\langle antiA \rangle$ , and the neutrosophic universal set  $U$  are illdefined, inexact, unknown (especially if we deal with predictions; for example, if  $\langle A \rangle$  is a statement with some degree of chance of occurring, with another degree of chance of not occurring, plus an unknown part). In the general case, none of the sets  $\langle A \rangle$ ,  $\langle neutA \rangle$ ,  $\langle antiA \rangle$ ,  $\langle nonA \rangle$  are completely included in  $U$ , and neither  $U$  is completely known; for example, if  $U$  is the neutrosophic universal set of some specific given events, what about an unexpected event that might belong to  $U$ ? That's why an approximate  $U$  (with vague borders) leaves room for expecting the unexpected.

The Neutrosophic Diagram in the general case is the following (Fig. 2): the borders of  $\langle A \rangle$ ,  $\langle antiA \rangle$ , and  $\langle neutA \rangle$  are dotted since they are unclear.

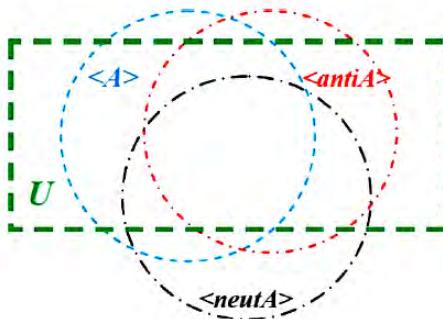


Fig. 5.2: Neutrosophic Diagram

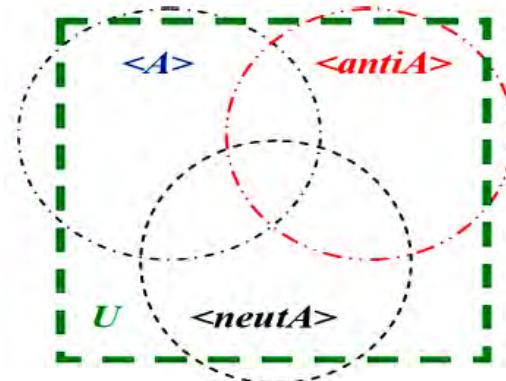
Similarly, the border of the neutrosophic universal set  $U$  is dotted, meaning also unclear, so  $U$  may not completely contain  $\langle A \rangle$ , nor  $\langle neutA \rangle$  or  $\langle antiA \rangle$ , but  $U$

“approximately” contains each of them. Therefore, there are elements in  $\langle A \rangle$  that may not belong to  $U$ , and the same thing for  $\langle neutA \rangle$  and  $\langle antiA \rangle$ . Or elements, in the most ambiguous case, there may be elements in  $\langle A \rangle$  and in  $\langle neutA \rangle$  and in  $\langle antiA \rangle$  which are not contained in the universal set  $U$ .

Even the neutrosophic universal set is ambiguous, vague, and with unclear borders.

Of course, the intersections amongst  $\langle A \rangle$ ,  $\langle neutA \rangle$ ,  $\langle antiA \rangle$ , and  $U$  may be smaller or bigger or even empty depending on each particular case.

See below an example of a particular neutrosophic diagram (Fig. 3), when some intersections are contained by the neutrosophic universal set:



*Fig. 5.3: Example of a particular neutrosophic diagram*

A neutrosophic diagram is different from a Venn diagram since the borders in a neutrosophic diagram are vague. When all borders are exact and all intersections

among  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ , and  $\langle \text{anti}A \rangle$  are empty, and all  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ , and  $\langle \text{anti}A \rangle$  are included in the neutrosophic universal set  $U$ , then the neutrosophic diagram becomes a Venn diagram.

The neutrosophic diagram, which complies with the neutrosophic logic and neutrosophic set, is an extension of the Venn diagram.

## 5.6. Classes of neutrosophic paradoxes

The below classes of neutrosophic paradoxes are not simply word puzzles. They may look absurd or unreal from the classical logic and classical set theory perspective. If  $\langle A \rangle$  is a precise / exact idea, with well-defined borders that delimit it from others, then of course the below relationships do not occur.

But let  $\langle A \rangle$  be a vague, imprecise, ambiguous, not-wellknown, not-clear-boundary entity,  $\langle \text{non}A \rangle$  means what is not  $\langle A \rangle$ , and  $\langle \text{anti}A \rangle$  means the opposite of  $\langle A \rangle$ .  $\langle \text{neut}A \rangle$  means the neutralities related to  $\langle A \rangle$  and  $\langle \text{anti}A \rangle$ , neutralities which are in between them.

When  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ ,  $\langle \text{anti}A \rangle$ ,  $\langle \text{non } A \rangle$ ,  $U$  are uncertain, imprecise, they may be selfcontradictory. Also, there are cases when the distinction between a set and its elements is not clear.

Although these neutrosophic paradoxes are based on “pathological sets” (those whose properties are considered atypically counterintuitive), they are not referring to the theory of Meinongian objects (*Gegenstandstheorie*) such as round squares, unicorns, etc. Neutrosophic paradoxes are not reported to objects, but to vague, imprecise, unclear

ideas or predictions or approximate notions or attributes from our everyday life.

## 5.7. Neutrosophic operators

Let's introduce for the first time two new Neutrosophic Operators:

1. An operator that “neuterizes” an idea. **To neuterize** [neuter+ize, transitive verb; from the Latin word *neuter* = neutral, in neither side],  $n(.)$ , means to map an entity to its neutral part. [We use the Segoe Print for “ $n(.)$ ”.]

“To neuterize” is different from “to neutralize” [from the French word *neutraliser*] which means to declare a territory neutral in war, or to make ineffective an enemy, or to destroy an enemy.

$n(<A>) = <\text{neut}A>$ . By definition  $n(<\text{neut}A>) = <\text{neut}A>$ .

For example, if  $<A>$  is “*tall*”, then  $n(\text{tall}) = \text{medium}$ , also  $n(\text{short}) = \text{medium}$ ,  $n(\text{medium}) = \text{medium}$ .

But if  $<A>$  is “ $1 + 1 = 2$  in base 10”, then  $n(<1 + 1 = 2 \text{ in base } 10>) = <\text{undefined}>$  (does not exist), and similarly  $n(<1 + 1 \neq 2 \text{ in base } 10>) = <\text{undefined}>$ .

2. An operator that “antonymizes” an idea. **To antonymize** [antonym+ize, transitive verb; from the Greek work *antonymia* = instead of, opposite],  $a(.)$ , means to map an entity to its opposite. [We use the Segoe Print for  $a(.)$ ]  $a(<A>) = <\text{anti}A>$ .

For example, if  $\langle A \rangle$  is “*tall*”, then  $\alpha(\text{tall}) = \text{short}$ , also  $\alpha(\text{short}) = \text{tall}$ , and  $\alpha(\text{medium}) = \text{tall or short}$ .

But if  $\langle A \rangle$  is “ $1 + 1 = 2$  in base 10”, then  $\alpha(\langle 1 + 1 = 2 \text{ in base } 10 \rangle) = \langle 1 + 1 \neq 2 \text{ in base } 10 \rangle$  and reciprocally  $\alpha(\langle 1 + 1 \neq 2 \text{ in base } 10 \rangle) = \langle 1 + 1 = 2 \text{ in base } 10 \rangle$ .

The classical operator for *negation / complement* in logics respectively in set theory, “*to negate*” ( $\neg$ ), which is equivalent in neutrosophy with the operator “*to nonize*” (i.e. *to non+ize*) or *nonization* (i.e. *non+ization*), means to map an idea to its neutral or to its opposite (a union of the previous two neutrosophic operators: *neuterization* and *antonymization*):

$$\neg\langle A \rangle = \langle \text{non } A \rangle = \langle \text{neut } A \rangle \cup \langle \text{anti } A \rangle = \text{n}(\langle A \rangle) \cup \alpha(\langle A \rangle).$$

Neutrosophic Paradoxes result from the following *neutrosophic logic / set connectives* following all apparently impossibilities or semi-impossibilities of neutrosophically connecting  $\langle A \rangle$ ;  $\langle \text{anti } A \rangle$ ;  $\langle \text{neut } A \rangle$ ;  $\langle \text{non } A \rangle$ , and the neutrosophic universal set  $U$ .

## 5.8. Neutrosophic truth tables

For  $\langle A \rangle = \text{“tall”}$ :

$\langle A \rangle$	$\alpha(\langle A \rangle)$	$\text{n}(\langle A \rangle)$	$\neg\langle A \rangle$
tall	short	medium	short or medium
medium	short or tall	medium	short or tall
short	tall	medium	tall or medium

To remark that  $n(<\text{medium}>) \triangleq \text{medium}$ . If  $<A> = \text{tall}$ , then  $<\text{neut } A> = \text{medium}$ , and  $<\text{neut}(\text{neut } A)> = <\text{neut } A>$ , or  $n(<n(<A>)>) = n(<A>)$ .

To remark that  $n(<\text{medium}>) \triangleq \text{medium}$ . If  $<A> = \text{tall}$ , then  $<\text{neut } A> = \text{medium}$ , and  $<\text{neut}(\text{neut } A)> = <\text{neut } A>$ , or  $n(<n(<A>)>) = n(<A>)$ .

For  $<A> = "1 + 1 = 2 \text{ in base 10}"$  we have  $<\text{anti } A> = <\text{non } A> = "1 + 1 \neq 2 \text{ in base 10}"$ , while  $<\text{neut } A>$  is undefined (N/A) — whence the neutrosophic truth table becomes:

For  $<A> = "1 + 1 = 2 \text{ in base 10}"$  we have  $<\text{anti } A> = <\text{non } A> = "1 + 1 \neq 2 \text{ in base 10}"$ , while  $<\text{neut } A>$  is undefined (N/A) - whence the neutrosophic truth table becomes:

$<A>$	$a(<A>)$	$n(<A>)$	$\neg<A>$
True	False	N/A	False
False	True	N/A	True

In the case when a statement is given by its neutrosophic logic components  $<A> = (T, I, F)$ , i.e.  $<A>$  is  $T\%$  true,  $I\%$  indeterminate, and  $F\%$  false, then the neutrosophic truth table depends on the defined neutrosophic operators for each application.

## 5.9. Neutrosophic operators and classes of neutrosophic paradoxes

### 5.9.1. Complement/Negation

$\neg<A> \neq <\text{non } A>$  and reciprocally  $\neg<\text{non } A> \neq <A>$ .

$\neg(\neg<A>) \neq <A>$

$\neg(\neg<\text{anti } A>) \neq <\text{anti } A>$

$\neg(\neg<\text{non } A>) \neq <\text{non } A>$

$\neg(\neg<\text{neut } A>) \neq <\text{neut } A>$

$\neg(\neg U) \neq U$ , where  $U$  is the neutrosophic universal set.  $\neg(\neg<\emptyset>) \neq <\emptyset>$ , where  $<\emptyset>$  is the neutrosophic empty set.

#### 5.9.2. Neuterization

$n(<A>) \neq <\text{neut } A>$

$n(<\text{anti } A>) \neq <\text{neut } A>$

$n(<\text{non } A>) \neq <\text{neut } A>$

$n(n(<A>)) \neq <A>$

#### 5.9.3. Antonymization

$a(<A>) \neq <\text{anti } A>$

$a(<\text{anti } A>) \neq <A>$

$a(<\text{non } A>) \neq <A>$

$a(a(<A>)) \neq <A>$

#### 5.9.4. Intersection/Conjunction

$<A> \cap <\text{non } A> \neq \emptyset$  (neutrosophic empty set) [symbolically  $(\exists x)(x \in A \wedge x \in \neg A)$  ],

or even more  $<A> \cap <\text{anti } A> \neq \emptyset$  [symbolically  $(\exists x)(x \in A \wedge x \in a(A))$  ],

similarly  $<A> \cap <\text{neut } A> \neq \emptyset$  and  $<\text{anti } A> \cap <\text{neut } A> \neq \emptyset$ ,

up to  $<A> \cap <\text{neut } A> \cap <\text{anti } A> \neq \emptyset$ .

The symbolic notations will be in a similar way.

This is *Neutrosophic Transdisciplinarity*, which means to find common features to uncommon entities.

For examples: There are things which are good and bad in the same time.

There are things which are good and bad and medium in the same time (because from one point of view they may be god, from other point of view they may be bad, and from a third point of view they may be medium).

### 5.9.5. Union / Weak Disjunction

$\langle A \rangle \cup \langle \text{neut } A \rangle \cup \langle \text{anti } A \rangle \neq U.$

$\langle \text{anti } A \rangle \cup \langle \text{neut } A \rangle \neq \langle \text{non } A \rangle.$

Etc.

### 5.9.6. Inclusion/Conditional

$\langle A \rangle \subset \langle \text{anti } A \rangle$

$(\forall x)(x \in A \rightarrow x \in a(A))$

All is  $\langle \text{anti } A \rangle$ , the  $\langle A \rangle$  too.

All good things are also bad.

All is imperfect, the perfect too.

$\langle \text{anti } A \rangle \subset \langle A \rangle$

$(\forall x)(x \in a(A) \rightarrow x \in A)$

All is  $\langle A \rangle$ , the  $\langle \text{anti } A \rangle$  too.

All bad things have something good in them [this is rather a fuzzy paradox].

All is perfect things are imperfect in some degree.

$\langle \text{non } A \rangle \subset \langle A \rangle$

$(\forall x)(x \in \neg A \rightarrow x \in A)$

All is  $\langle A \rangle$ , the  $\langle \text{non } A \rangle$  too.

All bad things have something good and something medium in them [this is a neutrosophic paradox, since it is based on good, bad, and medium].

All is perfect things have some imperfection and mediocrity in them at some degree.

$\langle A \rangle \subset \langle \text{neut } A \rangle$

$(\forall x)(x \in A \rightarrow x \in n(A))$

All is  $\langle \text{neut } A \rangle$ , the  $\langle A \rangle$  too.

$\langle \text{non } A \rangle \subset \langle \text{neut } A \rangle$  [partial neutrosophic paradox of inclusion]

$(\forall x)(x \in \neg A \rightarrow x \in n(A))$

All is  $\langle neutA \rangle$ , the  $\langle non A \rangle$  too.

$\langle non A \rangle \subset \langle antiA \rangle$  [partial neutrosophic paradox of inclusion]

$(\forall x)(x \in \neg A \rightarrow x \in a(A))$

All is  $\langle antiA \rangle$ , the  $\langle non A \rangle$  too.

$\langle antiA \rangle \subset \langle neut A \rangle$

$(\forall x)(x \in a(A) \rightarrow x \in n(A))$

All is  $\langle neut A \rangle$ , the  $\langle anti A \rangle$  too.

$\langle A \rangle \cup \langle anti A \rangle \subset \langle neut A \rangle$

$(\forall x)((x \in A \vee x \in a(A)) \rightarrow x \in n(A))$

All is  $\langle neutA \rangle$ , the  $\langle A \rangle$  and  $\langle antiA \rangle$  too.

### *Paradoxes of some Neutrosophic Arguments*

$\langle A \rangle \Rightarrow \langle B \rangle$

$\langle B \rangle \Rightarrow \langle anti A \rangle$

$\therefore \langle A \rangle \Rightarrow \langle anti A \rangle$

Example: too much work produces sickness; sickness produces less work (absences from work, low efficiency); therefore, too much work implies less work (this is a *Law of Self-Equilibrium*).

$\langle A \rangle \Rightarrow \langle B \rangle$

$\langle B \rangle \Rightarrow \langle non A \rangle$

$\therefore \langle A \rangle \Rightarrow \langle non A \rangle$

$\langle A \rangle \Rightarrow \langle B \rangle$

$\langle B \rangle \Rightarrow \langle neut A \rangle$

$\therefore \langle A \rangle \Rightarrow \langle neut A \rangle$

#### **5.9.7. Equality/Biconditional**

##### *Unequal Equalities*

$\langle A \rangle \neq \langle A \rangle$

which symbolically becomes  $(\exists x)(x \in \neg A \leftrightarrow x \notin \neg A)$  or even stronger inequality  $(\forall x)(x \in \neg A \leftrightarrow x \notin \neg A)$ .

Nothing is  $\langle A \rangle$ , nor even  $\langle A \rangle$ .

$\langle \text{anti } A \rangle \neq \langle \text{anti } A \rangle$

which symbolically becomes  $(\exists x)(x \in A \leftrightarrow x \notin A)$

or even stronger inequality  $(\forall x)(x \in A \leftrightarrow x \notin A)$ .

$\langle \text{neut } A \rangle \neq \langle \text{neut } A \rangle$

which symbolically becomes  $(\exists x)(x \in vA \leftrightarrow x \notin vA)$

or even stronger inequality  $(\forall x)(x \in vA \leftrightarrow x \notin vA)$ .

$\langle \text{non } A \rangle \neq \langle \text{non } A \rangle$

which symbolically becomes  $(\exists x)(x \in \neg A \leftrightarrow x \notin \neg A)$

or even stronger inequality  $(\forall x)(x \in \neg A \leftrightarrow x \notin \neg A)$ .

### *Equal Inequalities*

$\langle A \rangle = \langle \text{anti } A \rangle$

$(\forall x)(x \in A \leftrightarrow x \in a(A))$

All is  $\langle A \rangle$ , the  $\langle \text{anti } A \rangle$  too; and reciprocally, all is  $\langle \text{anti } A \rangle$ , the  $\langle A \rangle$  too. Or, both combined implications give: All is  $\langle A \rangle$  is equivalent to all is  $\langle \text{anti } A \rangle$ .

And so on:

$\langle A \rangle = \langle \text{neut } A \rangle$

$\langle \text{anti } A \rangle = \langle \text{neut } A \rangle$

$\langle \text{non } A \rangle = \langle A \rangle$

### *Dilations and Absorptions*

$\langle \text{anti } A \rangle = \langle \text{non } A \rangle,$

which means that  $\langle \text{anti } A \rangle$  is dilated to its neutrosophic superset  $\langle \text{non } A \rangle$ , or  $\langle \text{non } A \rangle$  is absorbed to its neutrosophic subset  $\langle \text{anti } A \rangle$ .

Similarly for:

$\langle \text{neut } A \rangle = \langle \text{non } A \rangle$

$\langle A \rangle = U$

$\langle \text{neut } A \rangle = U$

$\langle \text{anti } A \rangle = U$

$\langle \text{non } A \rangle = U$

### 5.9.8. Combinations

Combinations of the previous single neutrosophic operator equalities and/or inequalities, resulting in more neutrosophic operators involved in the same expression.

For examples:

$\langle \text{neut } A \rangle \cap (\langle A \rangle \cup \langle \text{anti } A \rangle) \neq \emptyset$  [two neutrosophic operators].

$\langle A \rangle \cup \langle \text{anti } A \rangle \neq \neg \langle \text{neut } A \rangle$  and reciprocally  $\neg(\langle A \rangle \cup \langle \text{anti } A \rangle) \neq \langle \text{neut } A \rangle$ .

$\langle A \rangle \cup \langle \text{neut } A \rangle \neq \neg \langle \text{anti } A \rangle$  and reciprocally.

$\neg(\langle A \rangle \cup \langle \text{neut } A \rangle \cup \langle \text{anti } A \rangle) \neq \emptyset$  and reciprocally.

Etc.

### 5.9.9. Other logical connectors

We can also take into consideration other logical connectors, such as strong disjunction (we previously used the weak disjunction), Shaffer's connector, Peirce's connector, and extend them to the neutrosophic form.

### 5.9.10. Substitutions

We may substitute  $\langle A \rangle$  by some entities, attributes, statements, ideas and get nice neutrosophic paradoxes, but not all substitutions will work properly.

## 5.10. Some particular paradoxes

### 5.10.1. Quantum semi-paradox

Let's go back to 1931 Schrödinger's paper. Saul Youssef writes (flipping a *quantum coin*) in *arXiv.org* at *quant-ph/9509004*:

"The situation before the observation could be described by the distribution  $(1/2, 1/2)$  and after observing heads our description would be adjusted to  $(1, 0)$ . The

problem is, what would you say to a student who then asks: “Yes, but what causes  $(1/2, 1/2)$  to evolve into  $(1, 0)$ ? How does it happen?”

It is interesting. Actually we can say the same for any probability different from 1: If at the beginning, the probability of a quantum event,  $P(\text{quantum event}) = p$ , with  $0 < p < 1$ , and if later the event occurs, we get to  $P(\text{quantum event}) = 1$ ; but if the event does not occur, then we get  $P(\text{quantum event}) = 0$ , so still a kind of contradiction.

#### **5.10.2. Torture's paradox**

An innocent person P, who is tortured, would say to the torturer T whatever the torturer wants to hear, even if P doesn't know anything.

So, T would receive incorrect information that will work against him/her. Thus, the torture returns against the torturer.

#### **5.10.3. Paradoxist psychological behavior**

Instead of being afraid of something, say  $\langle A \rangle$ , try to be afraid of its opposite  $\langle \text{anti}A \rangle$ , and thus (because of your fear) you'll end up with the  $\langle \text{anti}\langle \text{anti}A \rangle \rangle$ , which is  $\langle A \rangle$ .

Paradoxically, negative publicity attracts better than positive one (enemies of those who do negative publicity against you will sympathize with you and become your friends).

Paradoxistically [word coming etymologically from *paradoxism, paradoxist*], to be in opposition is more poetical and interesting than being opportunistic.

At a sportive, literary, or scientific competition, or in a war, to be on the side of the weaker is more challenging

but on the edge of chaos and, as in *Complex Adoptive System*, more potential to higher creation.

#### 5.10.4. Law of Self-Equilibrium

(Already cited above at the Neutrosophic Inclusion/Conditional Paradoxes)  $\langle A \rangle \rightarrow \langle B \rangle$  and  $\langle B \rangle \rightarrow \langle \text{anti}A \rangle$ , therefore  $\langle A \rangle \rightarrow \langle \text{anti}A \rangle$  !

Example: too much work produces sickness; sickness produces less work (absences from work, low efficiency); therefore, too much more implies less work.

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Originally published in PROGRESS IN PHYSICS,  
Volume 4 (2010), Issue 4 (October), p. 18-23. Reviewed.

## REVIEWS&ABSTRACTS

## 6. Unparticle, a Special Case of Unmatter

The idea of **unparticle** was first considered by F. Smarandache in 2004, 2005 and 2006, when he uploaded a paper on CERN website and published three papers about what he called “unmatter,” which is a new form of matter formed by matter and antimatter that bind together.

Unmatter was introduced in the context of “neutrosophy” (Smarandache, 1995) and “paradoxism” (Smarandache, 1980), which are based on combinations of opposite entities “A” and “antiA” together with their neutralities “neutA” that are in between.

In 2006 E. Goldfain introduced the concept of “fractional number of field quanta” and he conjectured that these exotic phases of matter may emerge in the near or deep ultraviolet sector of quantum field theory, as a result of non-equilibrium dynamics and the onset of complex behavior.

In the TeV sector the hypothetical high energy states consist of arbitrary mixtures of particles and antiparticles, which are similar to unparticles, and thus unparticles are particular cases of unmatter.

H. Georgi proposed the theory of unparticle physics in 2007 that conjectures matter that cannot be explained in terms of particles using the Standard Model of particle physics, because its components are scale invariant.

Unparticles are massless fields of nonintegral scaling dimensions.

Abstract Submitted on 28 Apr 2011 for the *DPP11 Meeting*  
of *The American Physical Society*.

## 7. Connection Between Unparticle and Unmatter

The connection between *unparticle* and *unmatter* is as follows. Unparticles have very odd properties which result from the fact that they represent fractional field quanta. Unparticles are manifested as mixed states that contain arbitrary mixtures of particles and antiparticles (therefore they simultaneously evolve “forward” and “backward” in time). From this, the connection with unmatter (since unmatter is formed by particles and antiparticles). Using the fractal operators of differentiation and integration we get the connection between unparticle and unmatter. *Unmatter* was coined by F. Smarandache in 2004 in CERN's website; he published three papers on the subject.

Abstract Submitted on 04 Oct 2010 for the *CAL10 Meeting of The American Physical Society*.

## 8. Neutrosophic Physics as A New Field of Research

Neutrosophic Physics describes collections of objects or states that are individually characterized by opposite properties, or are characterized neither by a property nor by the opposite of that property.

Neutrosophic Physics means a mixture of physical concepts/ideas/spaces/laws/theories  $\langle A \rangle$  with their opposite  $\langle \text{anti}A \rangle$  or with their neutral  $\langle \text{neut}A \rangle$  [where  $\langle \text{neut}A \rangle$  means neither  $\langle A \rangle$  nor  $\langle \text{anti}A \rangle$ , but in between, i.e. the neutral part], and it is a combination of heterogeneous contradictory things which hold together.

There are many cases in scientific fields (and in humanistic fields) that an item  $\langle A \rangle$  and its opposite  $\langle \text{anti}A \rangle$  or their neutral  $\langle \text{neut}A \rangle$  are simultaneously valid.

See below some examples of neutrosophic entities:

1. in two spatial dimensions, anyons are arbitrary spin particles that are neither bosons (integer spin) nor fermions (half integer spin);

2. among possible Dark Matter candidates there may be exotic particles that are neither Dirac nor Majorana fermions;

3. mercury (Hg) is a state that is neither liquid nor solid under normal conditions at room temperature;

4. non-magnetic materials are neither ferromagnetic nor anti-ferromagnetic;

5. quark gluon plasma (QGP) is a phase formed by quasi-free quarks and gluons that behaves neither like a conventional plasma nor as an ordinary liquid;
6. unmatter, which is formed by matter and antimatter that bind together (Smarandache, 2004);
7. neutral Kaon, which is a pion & anti-pion composite (Santilli, 1978) and therefore a form of unmatter;
8. neutrosophic methods in General Relativity (Rabounski-Smarandache-Borissova, 2005);
9. neutrosophic cosmological model (Rabounski-Borissova, 2011);
10. neutrosophic gravitation (Rabounski).

Etymologically, neutro-sophy [French neutre < Latin neuter, neutral, and Greek sophia, skill/wisdom] means knowledge of neutral thought, and started in 1995.

Neutrosophic Physics is derived from Neutrosophic Logic, Neutrosophic Set, Neutrosophic Probability and Statistics, which have many applications.

Researchers are invited to submit papers to [fsmarandache@gmail.com](mailto:fsmarandache@gmail.com) or [smarand@unm.edu](mailto:smarand@unm.edu) about physical entities that have contradictory properties, or have neither a property nor the opposite of that property, to the author for a collective volume on Neutrosophic Physics.

### Acknowledgement

The author addresses his thanks to Ervin Goldfain, Dmitri Rabounski, Larissa Borissova, and Thomas R. Love for their suggestions about this paper.

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## 9. Neutrosophic Degree of Paradoxicity of a Scientific Statement

Let  $\langle S \rangle$  be a scientific statement (in physics, mathematics, etc.). Let's also consider the implication ( $C_1$ ) "If  $\langle S \rangle$  is true it may result that  $\langle S \rangle$  is false," and the reciprocal implication ( $C_2$ ) "If  $\langle S \rangle$  is false it may result that  $\langle S \rangle$  is true." Both implications (conditionals) depend on other factors in order to occur or not, or they are partially true (T), partially indeterminate (I), and partially false (F) [as in neutrosophic logic]. If the implication ( $C_1$ ) has the neutrosophic truth value  $(T_1; I_1; F_1)$ ; and the reciprocal implication ( $C_2$ ) has the neutrosophic truth value  $(T_2; I_2; F_2)$ , then *the neutrosophic degree of paradoxicity of the statement  $\langle S \rangle$*  is the average of the component triplets:

$$((T_1+T_2)/2; (I_1+I_2)/2; (F_1+F_2)/2);$$

where the addition of two sets A and B (in the case when T, I, or F are sets) is simply defined as:

$$A + B = \{x|x = a + b, \text{with } a \in A \text{ and } b \in B\}.$$

Abstract Submitted on 24 Aug 2011 for the *4CF11 Meeting of The American Physical Society*.

## 10. The Multispace with Its Multistructure as Unified Field Theory

Let  $S_1, S_2, \dots, S_n$  be  $n$  structures on respectively the sets  $M_1, M_2, \dots, M_n$ , where  $n \geq 2$  ( $n$  may even be infinite). The structures  $S_i$ ,  $i = 1, 2, \dots, n$ , may not necessarily be distinct two by two; each structure  $S_i$  may be or not  $n_i$ -concentric, for  $n_i \geq 1$ . And the sets  $M_i$ ,  $i = 1, 2, \dots, n$ , may not necessarily be disjoint, also some sets  $M_i$  may be equal to or included in other sets  $M_j$ ,  $j = 1, 2, \dots, n$ . We defined the multispace  $M$  as a union of the previous sets:  $M = M_1 \cup M_2 \cup \dots \cup M_n$ , hence we have  $n$  (different or not, overlapping or not) structures on  $M$ .

A multi-space is a space with many structures that may overlap, or some structures may include others or may be equal, or the structures may interact and influence each other as in our everyday life.

Therefore, for a unified field theory we build a multispace  $M$  with a multistructure as a union of a gravitational space, electromagnetic space, weak interactions space, and strong interactions space. Then we construct a corresponding physical model.

Abstract Submitted on 02 Oct 2011 for the *PSF11 Meeting of The American Physical Society*.

## 11. Multispace and Multistructure as a Theory of Everything

In a general definition, a multispace (also spelt multi-space) is a finite or infinite (countable or uncountable) union of many spaces that have various structures.

The spaces may overlap. A such multispace can be used in physics for the Unified Field Theory that tries to unite the gravitational, electromagnetic, weak and strong interactions. Or in the parallel quantum computing and in the mu-bit theory, in multi-entangled states or particles and up to multi-entangles objects.

It is believed that the multispace with its multistructure is the best candidate for 21st century Theory of Everything in any domain. It connects many knowledge fields.

The multispace is a qualitative notion, since it is too large and includes both metric and non-metric spaces.

The notion of multispace was introduced by the author in 1969 under the idea of hybrid mathematics: combining different fields into a unifying field, which is closer to our real life, since we don't have a homogeneous space, but many heterogeneous ones.

As applications we also mention: the algebraic multispaces (multi-groups, multi-rings, multi-vector spaces, multi-operation systems and multi-manifolds, also multi-voltage graphs, multi-embedding of a graph in an n-

manifold, etc.), geometric multispace (combinations of Euclidean and Non-Euclidean geometries into one space as in Smarandache geometries), theoretical physics, including the relativity theory, the M-theory and the cosmology, then multi-space models for p-branes and cosmology, etc.

Abstract Submitted on 26 Aug 2011 for the *NWS11*  
*Meeting of The American Physical Society.*

## 12. Five Paradoxes and a General Question on Time Traveling

### 12.1. Traveling to the past

Joe<sub>40</sub>, who is 40 years old, travels 10 years back to the past when he was 30 years old. He meets himself when he was 30 years old, let's call this Joe<sub>30</sub>.

Joe<sub>40</sub> kills Joe<sub>30</sub>.

If so, we mean if Joe died at age 30 (because Joe<sub>30</sub> was killed), how could he live up to age 40?

### 12.2. Traveling to the future

Joe<sub>30</sub>, who is 30 years old, travels 10 years in the future and meets himself when he will be 40 years old, let's call him Joe<sub>40</sub>.

Joe<sub>40</sub> kills Joe<sub>30</sub>.

At what age did Joe die, at 30 or 40?

If Joe<sub>30</sub> died, then Joe<sub>40</sub> would not exist.

### 12.3. Traveling pregnant woman

a) A 3-month pregnant woman, Jane<sub>3</sub>, travels 6 months to the future where she gives birth to a child Johnny<sub>3</sub>.

b) Then she returns with the child back, and after 1 month she travels 5 months to the future exactly at the same time as before.

Then how is it possible to have at exactly the same time two different situations: first only the pregnant woman, and second the pregnant woman and her child?

## **12.4. Traveling in the past before birth**

Joe30, who is 30 years old, travels 40 years in the past, therefore 10 years before he was born.

How is it possible for him to be in the time when he did not exist?

## **12.5. Traveling in the future after death**

Joe30, who is 30 years old, travels 40 years in the future, 10 years after his death. He has died when he was 60 years old, as Joe60.

How is it possible for him to be in the time when he did not exist any longer?

## **12.6. A general question about time traveling**

When traveling say 50 years in the past [let's say from year 2010 to year 1960] or 50 years in the future [respectively from year 2010 to year 2060], how long does the traveling itself last?

If it's an instantaneous traveling in the past, is the time traveler jumping from year 2010 directly to year 1960, or is he continuously passing through all years in between 2010 and 1960?

If the traveling lasts longer say, a few units (seconds, minutes, etc.) of time, where will be the traveler at the second unit or third unit of time?

I mean, suppose it takes 5 seconds to travel from year 2010 back to year 1960; then in the 1st second is he in year 2000, in the 2nd second in year 1990, in the 3rd second in year 1980, in the 4st second in year 1970, and in the 5st second in year 1960?

So, his speed is 10 years per second?

Similar question for traveling in the future.

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## 13. Introduction to the Mu-bit

Mu-bit is defined here as 'multi-space bit'. It is different from the standard meaning of bit in conventional computation, because in Smarandache's multispace theory (also spelt multi-space) the bit is created simultaneously in many subspaces (that form together a multi-space). This new 'bit' term is different from multi-valued-bit already known in computer technology, for example as MVLong. This new concept is also different from qu-bit from quantum computation terminology. We know that using quantum mechanics logic we could introduce new way of computation with 'qubit' (quantum bit), but the logic remains Neumann. Now, from the viewpoint of m-valued multi-space logic, we introduce a new term: 'mu-bit' (from multi-space bit).

Abstract Submitted on 03 Sep 2010 for the *MARII Meeting*  
*of The American Physical Society.*

## 14. Introduction to SC-Potential

A new type of potential for nucleus, which is different from Coulomb potential or Yukawa potential, is introduced. This new called Smarandache-Christianto potential may have effect for radius range within  $r = 5\text{-}10$  fm. For experimental verification of this potential, we find possible applications in the context of Condensed Matter Nuclear reaction.

According to Takahashi's research, it is more likely to get condensed matter nuclear reaction using cluster of deuterium (4D) rather than using D+D reaction (as in hot-fusion, in this process Coulomb barrier is very high). In recent work, Takahashi shows that in the TSC framework it is also possible to do CMNS reaction not only with DDDD, but also with DDDH, DDHH, DHHH, or HHHH, where the reaction can be different.

In other words, TSC can be a mixture of heavy and light water (as in neutrosophic logic). More interestingly, his EQPET/TSC (*tetrahedra symmetric condensate*) model, Takahashi can predict a new potential called STTBA (*sudden-tall thin barrier approximate*) which includes negative potential (reverse potential) and differs from Coulomb potential. The SC-potential, which has sinusoidal form, can be viewed as a generalization of Takahashi's TSC/STTBA potential.

Abstract Submitted on 05 Oct 2010 for the *MARII Meeting of The American Physical Society*.

## 15. New Relativistic Paradoxes (new edition)

I have released a second edition of my latest book, *New Relativistic Paradoxes and Open Questions* (2012, The Educational Publisher). The first edition was published by Somipress (1983, Fes). The book is available from Amazon in print or Kindle editions.

Following the Special Theory of Relativity, I have generalized the Lorentz contraction factor to an oblique-contraction factor, which gives the contraction factor of the lengths moving at an oblique angle with respect to the motion direction. I assert that relativistic moving bodies are distorted, and compute the angle-distortion equations. I show several paradoxes, inconsistencies, contradictions and anomalies in the Theory of Relativity.

Not all physical laws are the same in all inertial reference frames, and I give several counter-examples. I support superluminal speeds, and consider that the speed of light in vacuum is variable depending on the moving reference frame. I explain that the redshift and blueshift are not entirely due to the Doppler effect, but also to the medium gradient and refraction index. I hypothesize that space is not curved and the light near massive cosmic bodies bends not because of gravity only as the General Theory of Relativity asserts (gravitational lensing), but because of medium lensing.

In order to make the distinction between “clock” and “time,” the book suggests a first experiment with a different clock type for the GPS clocks, for proving that the resultant dilation and contraction factors are different from those obtained with the cesium atomic clock; and a second experiment with different medium compositions for proving that different degrees of redshifts/blueshifts and different degrees of medium lensing would result.

Readers are encouraged to contact me at [fsmarandache@gmail.com](mailto:fsmarandache@gmail.com) or [smarand@unm.edu](mailto:smarand@unm.edu) with any questions or comments about the book.

*Letter to the Editor of INFINITE ENERGY.*

## 16. A Review on Di Hua's Relativity of Quantum Theories

On: Di Hua, *Back to Square One and Restart Anew / Deepening the Relativity Theory and Quantum Mechanics.* American Academic Press, Salt Lake City, USA, 135 p., 2015.

The problems that physicists must solve today are, to a large extent, questions that remain unanswered because of the incompleteness of the 20<sup>th</sup> century's scientific revolution. Inspite of great progress over the century, the two discoveries, of the relativity and of the quantum, remain incomplete. Each has defects that points to the existence of a deeper theory. There are two great problems in theoretical physics, today:

***Problem 1:*** To combine the special and the general theories of relativity, either by inventing a new theory that does sense or by making sense of the theory of relativity as it stands.

***Problem 2:*** To reseolve the problems in the foundations of quantum mechanics and combine the relativity theory and the quantum theory into a single theory that can claim to be the complete theory of nature.

These two problems together drive most current work on the frontier of theoretical physiscs.

Both the relativity theory and the quantum theory give a problem of *infinities* due to the Lorentz factor

$$\beta = \frac{1}{\sqrt{1 - v^2/c^2}}.$$

Moreover, the quantum theory gives only statistical predictions of subatomic behavior.

In my opinion, this Lorentz factor is not very useful in our reality. Our ability to do any better than that is limited by the uncertainty principle.

Problems come from the division of the world required to make sense of quantum theory. One difficulty is where you draw the dividing line between the micro and the macro.

The problems have not been solved after all this time; it is because something missing, a link between relativistic mechanics and quantum mechanics. The problem of quantum mechanics is unlikely to be solved in isolation.

I deeply admire the author for his courage to ignore fashion and attack the hardest and most fundamental problems.

As for his work under review, I am delighted to confirm:

1. The mathematical deductions look correct and its physical explanations may be reasonable. Lab experiments and astronomical observations will later be able to check them.
2. The theory, solely based on the Galilean transformation without any postulate, conforms fully with the principle of relativity and provides

a marvelous chain from micro-particle through macro-body to cosmology. [See also Absolute Theory of Relativity (1982)].

3. Especially significant is the seamless link between the relativistic mechanics and the quantum mechanics.

The publication of this monography will add a new name to the list of interesting physiscists of today.

## 17. Heisenberg Uncertainty Principle Extended to $n$ -Plets

All measurable properties of a physical system come in  $n$ -plets; as one measures a member of the  $n$ -plets very accurately, consequently the other left  $n-1$  members of the  $n$ -plets are measured very inaccurately. If there is a minimum uncertainty in a member's measurement, there is a maximum uncertainty in the other  $n-1$  members' measurements. The product of the  $n$  uncertainties corresponding respectively to the measurements of the  $n$  members is constant:

$u_1 \cdot u_2 \cdot \dots \cdot u_n = h = 6.626 \times 10^{-34} \text{ kg m}_2\text{s}^{-1}$ ,  
where  $h$  is Planck's constant.

### Open Question

If possible to simultaneously measure  $m$  members of the  $n$ -plets very accurately, for  $2 \leq m \leq n-1$  would consequently result that the other left  $n - m$  members of the  $n$ -plets are measured very inaccurately?

Abstract Submitted on 11 Aug 2013 for the *OSF13 Meeting  
of The American Physical Society*.

# BLOGS

## 18. Stars and Planets

*Questions:*

We know that the stars die after a long period of time.

- 1) After a star dies, then what happens with the planets around it?
- 2) Will they still rotate around the previous place of the star?
- 3) Or, will they joint another star, maybe the closest one, and rotate around it?
- 4) Or will they fly freely in the space and collide with other planets or stars?
- 5) Will the natural satellites of these planets still rotate around their planets or not?

Planets also die after a time.

- 1) Is their orbit filled in by another planet?
- 2) What is the impact of a planet dying (being destroyed) on the other planet in the same solar system?

If the stars die, then there should be a method that new stars are borne, if not, then the whole universe will die when all stars die [no life will survive any longer].

- 1) How do the new stars are then borne today?
- 2) Is it at any moment a small big bang giving birth to new (sub-)universes?

- 3) If a planet is destroyed, what happens with its moons?
- 4) The moons leave their positions for the cosmos, because they still not attracted by the central body (planet)?

*Dmitri Rabounski's answer:*

A. A star does not disappear at the final stage of its evolution, as a substance cannot disappear but only transforms into another sort of matter. When astrophysicists tell "a star dies" they mean three versions of this event:

a) The star is cooled down due to the end the fuel storage in it (no matter what fuel -- hydrogen in the process of nuclear fusion, or something else of the other, unknown sources of the stellar energy). Thus, the star becomes a relatively cold sphere of substance, which radiates so little that cannot be observed. At this stage the star compresses according to the laws of physics, becoming a compact object (not a giant sphere as earlier). Therefore, if there were planets orbiting the star, they still remain in their orbits, because the star's mass remains unchanged (so the orbits remains unchanged as well according to the laws of mechanics). However life will die in the planets being frozen.

b) The star's substance experiences a transit into another physical state. As a result, thermodynamics of the star changes, depending on the new state of its substance. A star can transform, at the final stage of its evolution, into

a collapsed sphere --- black hole, where no light or other matter can leave it due to the extra-strong gravitation, --- so the star becomes invisible. A star can transform into a "neutron state", in which the star does not radiate energy in the visible scale of the spectrum (no visible light observed), but still radiates in X-ray and gamma scales. In other word, the star truncates radiation in the most scales of the spectrum, but still radiates (with much power than earlier) in a small scale. As a result of the distribution of energy, the star radiates much, much lesser than earlier, and can live in this state for very long time, almost for eternity. In this case the planets do not remain at their old orbits, but become close to the star, according to the laws of mechanics. This is because neutron star can be born because of an explosion of a regular star, losing the most part of its mass for the energy radiated in the explosion. Also, all life in them deceased being killed by the strong X or gamma radiation.

Another end can be if the star becomes a white dwarf -- as well a special kind of stars which are very small in the size but very, very dense. Such a compression leads to truncating the necessary radiation due to truncating the surface of the compressed star in any million times. Thus, being in the state, the star can still live almost eternal (at least for very long time). In this case, the planets become also close to the star, because a white dwarf can be born after an explosion of a regular star.

c) The star explodes in "complete" so that it mass transfers into radiation and also into gas which ejects into

the cosmos constructing a gaseous nebula. In this case no exact centre of the gravitation remains in the old position of the star, so the planets, if not finally destroyed in the explosion, will travel into the cosmos according to their initially momenta, which is the sum of their orbital momenta in the moment of the explosion (disappearing the centre of gravitation) and the momenta the planets get from the explosion.

B. Planets -- solid spheres -- do not die with time. They may cool down if the star's radiation deceases. A planet can also be destroyed by the tidal forces, if approaching the star so close that crossing the Roche limit for the mass of the planet. But this is a very, very close distance. Thus, a planet cannot die. A solid stone is solid stone in any case, if no external power will destroy it.

C. Stars give birth at any time in the universe. We see, in many regions of the sky, the associations of very young stars. The process of birth is not understood in clear, but it is self-understood that stars appear from the compression of rare fracted matter such as the interstellar gas.

## 19. Unmatter

In the article "Unparticle physics" from

<http://www.spiritus-temporis.com/unparticle-physics/properties.html>

it is said that:

"In 2004, 2005 and 2006 F. Smarandache uploaded a set of documents on CERN web site and published three papers about what he called "unmatter", which according to his writings, represents a new bound form of matter and antimatter (a concept largely unrelated to "unparticles"). In 2006, prior to Georgi's proposal, E. Goldfain introduced the concept of "fractional number of field quanta". He conjectured that unparticles are nontrivial states of matter that may emerge in the near or deep TeV sector of high-energy physics, as a result of non-equilibrium dynamics and complex behavior."

But in the paper "On Emergent Physics, 'Unparticles' and Exotic 'Unmatter' States," by E. Goldfain and F. Smarandache, Prog. Phys., Vol. 4, 10-15, 2008, online at

[http://www.ptep-online.com/index\\_files/2008/PP-15-02.PDF](http://www.ptep-online.com/index_files/2008/PP-15-02.PDF)

and its abstract at The Smithsonian/NASA Astrophysics Data System:

<http://adsabs.harvard.edu/abs/2009APS>

it is explained the connection between unmatter (Smarandache's sense) and unparticle.

Unparticles are mixed states that contain arbitrary mixtures of particles and antiparticles, hence connection with unmatter.

The use of the fractal operators of differentiation and integration leads to the connection between unparticles and unmatter.

Therefore, according to the cited published article, the concept "unmatter" is related to the concept "unparticle".

Note: *Unparticle is formed by unmatter. Unmatter is combination of matter and antimatter.*

## 20. Nucleon clusters

I observed something interesting in Robert D. Davic's Table on Brightsen model prediction for nucleon clusters associated with electron orbitals for stable isotopes (H to B): each orbit has one or two clusters of unmatter type 2 of dimension 1 {i.e. one positive and one negative plus neutrals}, or dimension 2, i.e. two positives and two negatives plus neutrals.

Can we make it a physics law? Is it any orbital that has 3 or more such unmatter type 2 clusters?

So, the nucleon is formed by several unmatters type 2 clusters.

The clusters we talked about are not unmatter type 2 (at the level of protons, neutrons, and electrons).

What about thinking in terms of clusters of quarks and antiquarks (not protons, neutrons, and electrons) in Brigthsen Model?

## 21. Vacuum

*Question:* I thought vacuum would be some particular space where there is no particle and no field of any kind (no wave) too. So simply empty. Therefore energy zero. But it looks that in the universe such completely empty space does not exist.

What about the astronauts that fly in their rocket's cabin? Is there maybe a near-zero energy space? (But not zero?)

*Dmitri Rabounski's answer:*

All that you thought about vacuum was a result of the "mix" among the terminology. For example, the astronauts' cabin flies in not vacuum but in a space filled with fields and particles. There is not so much rarefaction to mean the space to be empty: even in an earthy lab, the scientists approach emptiness, not in the cosmic space --- a "soup" of the particles (solar wind) and electromagnetic fields.

A really near-zero space region is a very rare exotics. It is easier to get it in a laboratory than find somewhere in the cosmos.

## 22. Neutrosophic Numbers in Physics

I did together with Vic Christianto an interpretation of some physical equations we did using the quaternions and/or biquaternions.

We can do the same thing using the neutrosophic numbers, which are numbers of the form:  $N = a + bI$ , where  $a, b$  are real numbers and  $I$  = indeterminacy, with  $I^n = I$  {"I" is different from "i", which  $i = \text{sqr}(-1)$ }. Where  $a$ =real part, and  $b$ =indeterminate part of the number  $N$ .

Or more general:  $a + bI$ , where  $a, b$  are complex numbers.

So, some physical equations (especially in quantum physics, where there is a lot of indeterminacy), can be extended to neutrosophic format.

# CONFERENCES & PAPERS

## 23. American Physical Society – Conferences / Papers / Abstracts

(also see Bulletin of American Physical Society at  
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- Saturday, October 19–22, 2011; Roanoke, Virginia,  
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**About the author.**

Dr. Florentin Smarandache is a Professor of Mathematics at the University of New Mexico in USA. He published over 100 books and 300 articles and notes in mathematics, physics, philosophy, psychology, literature, arts. In mathematics his research is in number theory, non-Euclidean geometry, synthetic geometry, algebraic structures, statistics, neutrosophic logic and set (generalizations of fuzzy logic and set respectively), neutrosophic probability (generalization of classical and imprecise probability). Also, small contributions to nuclear and particle physics, information fusion, neutrosophy (a generalization of dialectics), law of sensations and stimuli, etc. He got the 2010 Telesio-Galilei Academy of Science Gold Medal, Adjunct Professor (equivalent to Doctor Honoris Causa) of Beijing Jiaotong University in 2011, and 2011 Romanian Academy Award for Technical Science.

This book is a collection of articles, notes, reviews, blogs and abstracts on Physics. Some are published for the first time here, some were previously published in journals, and revised here.

We approach a novel form of plasma, Unmatter Plasma. The electron-positron beam plasma was generated in the laboratory in the beginning of 2015. This experimental fact shows that unmatter, a new form of matter that is formed by matter and antimatter bind together (mathematically predicted a decade ago) really exists.

Further, we generalize the Lorentz Contraction Factor for the case when the lengths are moving at an oblique angle with respect to the motion direction, and show that the angles of the moving relativistic objects are distorted.

Then, using the Oblique-Length Contraction Factor, we show several trigonometric relations between distorted and original angles of moving object lengths in the Special Theory of Relativity.

We also discuss some paradoxes which we call “neutrosophic” since they are based on indeterminacy (or neutrality, i.e. neither true nor false), which is the third component in neutrosophic logic. We generalize the Venn diagram to a Neutrosophic Diagram, which deals with vague, inexact, ambiguous, ill-defined ideas, statements, notions, entities with unclear borders. We define the neutrosophic truth table, then we introduce two neutrosophic operators (neuterization and antonymization operators), and give many classes of neutrosophic paradoxes.

Other topics addressed in this book are: neutrosophic physics as a new field of research, neutrosophic numbers in physics, neutrosophic degree of paradoxity, unparticle and unmatter, multispace and multistructure, nucleon clusters, and others.

